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ABSTRACT

Science Unlimited (Pennsylvania Department of Education's elementary science effort) has developed a series of television programs for use in the primary and intermediate grades. These television programs form an integral part of science lessons which emphasize direct involvement of children with materials and ideas, provide for individual and group activities, are competency-based, use only easily available equipment and materials, and are keyed (via a curriculum matrix) to computer software and other resources. This guide contains the information necessary to teach lessons in which children in primary grades investigate: dripping faucets; classification and sorting; smell (preschool); eyes; color; air; weather; observation and description; change (early primary); simple machines; measurement; electricity; magnets; and the thermometer. This information includes (when applicable) lesson aims and competencies fostered, instructional strategies (including those related to use of the television program), list of materials/equipment needed, background information, and resource materials for the teacher. General comments about the nature and use of Science Unlimited in teaching science and the instructional approaches used in the program are provided in an introduction. (JN)

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SCIENCE UNLIMITED

Primary Lessons

1-15

WHAT IS SCIENCE UNLIMITED?

SCIENCE UNLIMITED is all of the following:

- An INQUIRY oriented science program
- A PROCESS oriented science program
- A program which stresses HANDS - ON STUDENT INVOLVEMENT
- A program which utilizes instructional television under the assumption that SCIENCE CAN NOT BE TAUGHT BY TELEVISION ALONE
- Competency based
- a program which stresses the AFFECTIVE areas of science education as being as important, if not more important than the cognitive areas

SCIENCE UNLIMITED is NOT:

- A textbook - oriented program
- Solely a lecture/discussion program

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IMPORTANT

IF YOU NEED HELP OR INFORMATION CONCERNING SCIENCE UNLIMITED:

CALL: 1-800-TELESCI TOLL FREE

HOURS: 9:00 a.m. till 4:00 p.m.

Persons knowledgeable concerning SCIENCE UNLIMITED will be available to provide help, advice, and information to you should you experience difficulty in implementing SCIENCE UNLIMITED.

IF YOU ARE UNABLE TO REACH 1-800-TELESCI: CALL (717) 783-6598

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We wish to express our special thanks and appreciation to the following for their efforts and generosity in allowing us to use materials and lessons which they developed and tested with children in their classrooms.

Altoona Area School District

Capitol Campus
The Pennsylvania State University
Elementary Science Graduate Classes of Dr. Roy Allison
  Dr. Roy Allison, who designed the majority of these lessons.

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SCIENCE UNLIMITED
SEQUENCE OF PROGRAMS

PRIMARY

WEEK TITLE

1. Observation and Description
2. Mystery Boxes
3. Classification and Sorting
4. Measurement
5. Smell
6. Eyes
7. Color
8. Air
9. Weather
10. Dripping Faucets
11. Change
12. Simple Machines
13. Electricity
14. Magnetism
15. The Thermometer
16. Seasons
17. Reflection of Light Beams
18. Drops
19. Fossils
20. Solar System
21. Energy
22. Animals
23. Plants
24. The Human Body
25. Nutrition
26. Communities
27. Oceanography
28. Small Things
29. Life Cycles
30. Ecology

INTERMEDIATE

1. Ice and Water
2. Chemistry
3. Color
4. Strips and Liquids
5. Heat Loss
7. Weather
8. Evaporation
9. Floating Things
10. Simple Machines
11. Bouncing Objects
12. Electricity
13. Energy
14. Heat
15. Heat Loss
16. Nutrition
17. Seasons
18. Solar System
19. Flight
20. Friction
21. Small Things
22. Things that Magnify
23. Plants
24. Sprouting Seeds
25. Human Body
26. Life Cycles
27. Communities
28. Oceanography
29. Animals
30. Ecology

SCIENCE UNLIMITED IS DIFFERENT

The televised program usually provides periods of silence during which the children and the teacher are interacting on such things as observations - interpretations - previous experiences-ideas.

The televised program, the teacher and the children comprise a three-way interaction group during the televised lesson.

. The teacher is part of it. You guide student participation with the help of this Handbook.

. The children are part of the TV program.

. The TV program raises questions to stimulate pupil response.

  - leads children into hands-on experimentation.
  - is part of a rational teaching strategy.

Each TV program is keyed to specific student competencies.

SCIENCE UNLIMITED Lesson Characteristics

. Emphasizes direct involvement of children with materials and ideas.

. Provides for individual and group activities.

. Is competency based.

. Uses only easily available equipment and materials, which can be found in may classrooms, can be brought in by the children, or can be purchased inexpensively locally.

. Allows children to generally internalize and to modify their knowledge, rather than to acquire non-conceptual verbalizations.

. Is competency based.

. Is keyed via the Curriculum Matrix to textbooks, computer software and other resources.

SCIENCE UNLIMITED is a resource to help teachers:

. experience interesting and worthwhile science investigations with children;

. gain insight into contemporary thinking about effective elementary science instruction;

. choose and use existing programs and textbooks;

. develop their own S.U. type lessons.

Using SCIENCE UNLIMITED

1. Know and use this SCIENCE UNLIMITED Handbook for Teachers. It will help to:

   - Launch your children and you into one of the lessons.
   - Introudce the complete lesson.
   - Provide a teacher strategy guide for use before, during and after the television program.
   - Provide you with student hands-on experiences and other complete lessons.
   - Help you to begin teaching process science.

2. Before the SCIENCE UNLIMITED Programs:

   - Read the section in this handbook related to the program both to see the relationship between the program and the follow-up lessons, and to prepare for your role during the TV presentation.
   - Collect the simple teaching materials you will need in the follow-up lessons.
   - Prepare to teach the first follow-up lesson immediately following the TV program or as soon as possible.

3. During the SCIENCE UNLIMITED Programs:

   - The children should be:
     - Seated informally so they can easily view the TV screen.
     - Feel free to respond to questions, react to observations on the TV screen, or do simple activities suggested by the program.
   - The teacher should be:
     - Located so as to view both the TV screen and the children.
     - Equipped with the teachers' guide or notes.
     - Ready to ask appropriate questions when discussion intervals "bog down."
     - Ready to analyze teaching strategies.
     - Ready to make mental or written notes which might be useful for the follow-up activities.
   - The discussion breaks are designed:
     - To stimulate student responses
     - To provide the teacher with a chance to practice SCIENCE UNLIMITED strategies.
     - To leave the children stimulated to continue thinking.

4. After the SCIENCE UNLIMITED programs:

- Respond to any spontaneous relevant questions or comments from the children.
- Make notes for appropriate modifications in the lessons indicated by the children's responses during the program.
- Teach the related SCIENCE UNLIMITED lessons, varying them according to your professional judgement.

TEACHING STRATEGIES

A TEACHING STRATEGY IS DEFINED..."as a rationale used by the teacher as basis for making professional decisions."

During any school day the classroom teacher makes many important professional decisions. Such decisions influence a teacher's questioning procedure, materials used, sequence followed and general classroom climate. Rational and consistent decision making require that the teacher develops strategies to use as a guide. Sound teaching strategies for the teaching profession should be based on principles of learning, philosophic points of view, empirical research or other rational bases.

Each ISEE-ITV program utilizes one or more of six selected teaching strategies, each based on an educational foundation and believed to support the aims of ISEE.

The strategies identified in this handbook are not peculiar to the teaching of science, making them useful in many areas of teaching and at many grade levels, including adult.

Involving you in the application of six strategies is not for the purpose of making you proficient at applying the one and only discussion period in the programs where a single strategy can be selected as the only one applicable. However, you should begin to sense a strategy that is major, as compared to those which are minor, in making decision.

The ultimate goal for including the six strategies as a part of this resource is to sensitize you to the need for a rationale, or reason, for most, if not all, decisions made in classroom teaching. it is our opinion that the basis used for decision-making in the classroom is probably the major characteristic that separates the professional from the paraprofessional.

STRATEGIES: an explanation -

Each televised program utilizes one or more of these strategies. When they occur, they are identified in the TV lesson guide sheet by a key symbol (in the Teacher's Guide to student-teacher-TV interaction).

1. Teacher questions require students to arrive at an answer by examining and manipulating the materials they are using.

2. Responses are accepted when students use evidence and behaviors from their lesson activities in observing, including and responding.

3. Student interpretations are considered acceptable, (even though they are partial or temporary conclusions), as long as the evidence from their investigations and experience supports their responses.

4. Reasonable time is provided during discussion for observation, thought and reflection.

5. Teacher questions and behaviors emphasize the use of processes such as observing, classfiying, communicating, measuring, inferring, predicting and experimenting.

6. Teacher questions encourage wider student thought and suggestions for additional investigative behavior

1. Teacher questions and statements require students to examine and manipulate the materials they are using to arrive at their answers.

ISEE IS COMMITTED TO DIRECT EXPERIENCE, ACTIVITY CENTERED LEARNING IN SCIENCE.

Most of the science ideas that young children can conceptualize are those within the limits of direct experiences. The children's interactions with simple materials provide the source of their beginning knowledge and, in most cases, should define the limits of their knowledge. It is usually inappropriate to ask children to generalize beyond the scope of their experiences, to formulate abstractions, or to accept abstractions.

The learning in ISEE lessons involves student interaction with materials as a means of generating both questions and answers by the student.

THE IDEAS (ANSWERS) OFTEN LEAD TO FURTHER ACTIVITIES IN AN EFFORT TO SEEK SUPPORTIVE OR MODIFYING EVIDENCE.

THE TEACHER SHOULD ENCOURAGE CHILDREN TO IDENTIFY AND PURSUE THE KINDS OF QUESTIONS THAT THEY WILL BE ABLE TO ANSWER BY "DOING SOMETHING" WITH "THINGS."

WE, AS TEACHERS, MUST ASK THE TYPES OF QUESTIONS YOUNG CHILDREN CAN ANSWER BY DIRECT OBSERVATIONS OF THINGS OR BY HOW THINGS INTERACT.

THE ABOVE THREE POINTS IMPLY:

A. "WHY" QUESTIONS ARE RARELY APPROPRIATE TO USE WITH YOUNG CHILDREN.

B. TEACHERS MUST FREQUENTLY RESTATE QUESTIONS ASKED BY CHILDREN SO THAT THE QUESTIONS ARE IN A FORM WHICH LEADS THE CHILDREN BACK TO OBSERVING AND INTERACTING WITH MATERIALS.

EXAMPLES

Enabling	Inhibiting
Tom, what did you do that was different from what Jean did? There must be a good reason for the different results you got.	Tom, you probably didn't leave the thermometer in the water long enough.
Why don't you both do it again to find out what caused your different observations?	Jimmie got the right answer. You must have done something wrong.
When you turn the big wheel once, what does the little wheel do?	Can you see how the big wheel is used to increase speed?
What might you do with your mystery box to try to find out how many objects are in it?	How many objects do you think the box contains?
(Child - Why doesn't my siphon work?) Watch me do it a few times to see if you can find out what you were doing that is different.	You didn't get all the air out of the tube. Hold one end at the bottom of the jar and the other near the top.
Ginny, you said the salt feels like sand. Could your hand lens help you find out more about the shape of salt and sand grains?	That's right, they both have sharp corners.
(Child - Why does the water drop roll around this piece of waxed paper and on the glass?) Why don't you try some other materials to find out how drops act on them?	Because glass has a stronger attraction for water than waxed paper does.

Jimmie says he is sure there is a rock in this mystery box. Let's list all our observations and see if they all fit Jimmie's conclusion.	It can't be a rock, Jimmie, because I didn't put any rocks in the boxes?

. . . .

Child - I think the salt is way up on the side of the jar because somebody must have shaken it. Teacher - That could explain it - How could we find out if shaking caused it?	No - nobody shook it. That is not the reason.

Ans. Evidence

2. Teacher fosters student support of their inferences by leading them to establish a direct relationship between their ideas and the observational evidence on which they are based.

SCIENCE KNOWLEDGE IS BUILT FROM AND UPON WHAT IS KNOWN.

Science investigation is a process of seeking evidence, i.e., that which can be known. To this end, we must continually encourage children to give concrete evidence to support an inference, statement of fact, or conclusion. Observations represent what we know. Inferences are tentative explanations, predictions or conclusions which fit our limited knowledge.

Instead of "wild guesses," children should be encouraged to make "educated guesses" based on what they know to be true, i.e., evidence.

The wise teacher avoids making authoritarian decisions as to whose ideas are right. In an investigation-centered science experience, children who make statements which are in conflict with the ideas of the teacher, the book, or other children can often be at least equally right. Differences in explanations may be due to differences in observations, amount of evidence available, communication skills, etc.

When children are challenged to produce the evidence to support a statement interesting outcomes may result, i.e.:

A. They may revise their statement.

B. They may justify their "different" interpretation.

C. They may recognize a need to repeat their original activity

D. They may identify a careless observation.

E. They gain insight into the interdependency between observations and inferences.

EXAMPLES

Enabling	Inhibiting
What did you observe that made you say that? Show us what you did and what you observed that gave you that idea. Try doing it again to check your observations.	No, that's wrong (or that's right).
Do you have a reason for saying that?	Rejecting (or accepting) an idea without giving children a chance to present their evidence.
What is your evidence for making that guess (prediction, etc.)?	Allowing children to argue a point without using observations or other appropriate evidence to defend their point of view.
Do we need more evidence before we can say that?	Accepting or inflicting abstract verbalizations for which children have no experiential foundation.
Have you had any experiences with ice changing to water or water changing to ice that might help you predict whether the water level will be higher, lower, or the same after the ice cubes melt?	Each of you make a guess whether the water level will be higher, lower, or the same after the ice melts.
Let's match your list of observations with you conclusion and see if they all support that statement.	But, that's not the right answer. This experiment is to prove that ______________________________.

Approval

3. Student interpretations are considered acceptable (even though they are partial or temporary conclusions) as long as the evidence from their investigations and experiences support their responses.

SCIENCE IS SELF CORRECTING. THAT IS: ANY EXPLANATIONS (EVEN THOSE OF SCIENTISTS) ARE TENTATIVE AND SUBJECT TO CHANGE AS NEW EVIDENCE IS ACQUIRED.

Science knowledge is dynamic. Whenever scientists encounter new evidence, they reexamine related theories, conclusions, etc. The new evidence may cause them to strengthen, revise, or reject existing ideas.

So, too, with young children. Their science concepts evolve through a sequence of partial truths - those that are true within the limits of their experience.

Each of us can only be as right as our observations, past experience and reasoning power permit us to be. As long as we regard our ideas as dynamic - i.e. subject to modification when conflicting new evidence is encountered - knowledge evolves in a pattern that is meaningful, that reflects openmindedness, and which is in keeping with the spirit of science.

At the elementary level, the child's explanations may fit his limited evidence and experience yet not be in agreement with ideas of the "expert." Any child's idea, justified by his evidence, should be accepted without condescension or qualifying statements such as "but...' or "however....," etc. Teacher Responses can reflect the idea of tentativeness by taking such form as:

1. That seems to explain what we now know.

2. Does that fit all we have observed?

3. Is there anything elese we can do to check our idea?

EXAMPLES

Enabling	Inhibiting
Child - Magnets attract only nails and paper clips, nothing else. Teacher - That agrees with our observations, so far.	Yes, magnets attract all iron and steel.
Child - The dripping water goes down the drain into the ground. Teacher - (No comment) (Perhaps arrange for children to visit a house under construction and revise this idea.)	No, it goes through pipes to the septic tank.
Child - There are two marbles in the box because (state relevant observations). Teacher, "You have found some real good clues." (Later when children compare, three clicks may be demonstrated.)	You didn't observe very carefully. If you had you would have heard three objects bump against the side.
(Observation and Description Lesson) Child - I think the answer is the aquarium. Teacher - That fits all the clues I gave you, doesn't it. But it isn't the object I have in mind. I guess you need another characteristic. The object would fit in your desk.	No, that's not the object I have in mind. Guess again.
The candle in the jar went out because it didn't have enough air. Teacher, accept with approval.	The real reason it went out was it didn't have enough oxygen (oxygen is merely a meaningless verbalization for young children.

. . . .

Child - All magnifiers must be made of something that has no coloring in it.
Teacher - Accept or make neutral statement such as: It certainly seems that none of the colored objects we used were good magnifiers.

But if there is only a pale coloring in the lens it will work. Think of tinted eyeglasses.

4. Reasonable time is provided during discussion for observation, thought, and reflection.

This practice involves what Mary Budd Rowe has titled "wait-time." Her research indicates that many teachers seem unable to tolerate periods of silence longer than one second during class discussion. If children are barraged with questions and pressured for immediate answers, they do not have time to involve themselves in the mental, observational and manipulative activities which are important to an investigative type science program.

BY INCREASING "WAIT-TIME" AFTER DISCUSSION QUESTIONS TO FIVE SECONDS, TEACHERS HAVE FOUND THAT MORE CHILDREN PARTICIPATE, THE QUALITY OF RESPONSES INCREASES, AND GREATER PUPIL TO PUPIL DISCUSSION OCCURS.

Children need time to think, to figure out, and to reconcile conflicting ideas. They need time to derive answers from observations. They need time to communicate their ideas. Discussion among children improves their communication skills. School is a place where children evolve their learning, not where they recite "right" answers.

Try to wait at least five seconds before calling on a child for a verbal contribution. Wait again, after the child's statement, to give the children in the group time to think about what has been said and to react with questions, additional information, statements of conflicting ideas, etc.

By increasing "wait-time" the talk pattern in a classroom often changes from:

Teacher-pupil-teacher-pupil, etc.
to
Teacher-pupil-pupil-pupil-teacher-pupil-pupil-teacher, etc.

Teachers might find statements similar to the following helpful in fostering effective use of wait-time.

1. I'm not going to call on anyone for a while so that each of you has a chance to think of what you want to say.

2. Think about it and raise your hand when you have an idea. I'll nod and you can put your hand down until others are ready with ideas.

3. I'll tilt the mystery box slowly several times so you can really hear the sounds and think about what they help you to know.

4. Think about what Johnny said and decide why you agree or you disagree with him.

5. Teacher questions and behaviors emphasize the use of Science processes including observing, classifying, communicating, measuring, inferring, predicting, and experimenting.

THE DEVELOPMENT OF SKILLS IN USING THE PROCESSES OF SCIENCE IS BASIC TO PRODUCTIVE INVESTIGATION IN SCIENCE.

The processes listed here are selected from those identified in the AIMS as being most appropriate for childen in the elementary grades.

OBSERVING

Looking
Listening
Feeling
Smelling
Tasting

CLASSIFYING

Identifying likenesses
Identifying differences
Grouping into sets

COMMUNICATING

Verbally
By Gesture
By Showing
By Drawing
Listening
Questioning

MEASURING

Size
Weight
Quantity (Volume)
Number

INFERRING

Using observations and past experiences to construct tentative explanations, conclusions, predictions, etc.

PREDICTING

(Extrapolating) Inferring a behavior by imagining an extension of a pattern which has been identified (by graph, table, list, etc.)

EXPERIMENTING

Identification and control of variables

These process skills are useful in curriculum areas other than science. Many teachers report that their first and second graders gradually transfer these skills to use in subjects other than science. The process skills are important in one's role as a consumer, as a citizen, or in interacting with people.

Example: Discriminating between inferences and observations.

Elementary teachers realize that children's ideas often exceed their ability to express them verbally. Because of this limitation, young children should be encouraged to use gestures, to demonstrate (with the actual materials) what they did, and to use other appropriate methods to convey their thoughts and their questions to classmates and to the teacher.

To help children grow intellectually and to grow in self-image, teachers are challenged to use all their ingenuity to:

a. convey to the child that both teacher and classmates are sincerely eager to understand what the child means;

b. avoid inferring, prematurely, the ideas the child is trying to convey.

Sample teacher statements that support communication skill growth:

1. Tell us a litte more about it.

2. Show us what you mean.

3. Would it help us to understand if you make a drawing on the chalkboard?

4. Try to say it another way.

5. Jimmy, you look confused. Can you ask a question to help us explain this better for you?

6. Jane, tell us in your own words what you think Anne means. That will help Anne find out if she has gotten her idea across.

7. I'm going to say it in another way and you can see if I understand what you mean.

6. Teacher questions and statements encourage wider student thought and suggestions for additional investigative behavior.

OBSERVATIONS AND CHILD-CENTERED DISCUSSIONS INVARIABLY LEAD TO QUESTIONS.

Investigation type science learning is often divergent since it focuses on what children find meaningful and what children ask about their observations. Some of the questions which arise can be directly answered by further investigation.

However, we should not let children feel that they can find or understand answers to all their questions. Let's face it, they can't. Some questions may need to be modified to divert the child's interest into something which can profitably be investigated by doing something.

When children report conflicting (or seemingly conflicting) outcomes to investigations, the conflict can usually be resolved best by going back to the materials to identify the source of disagreement, e.g.: inaccurate observation, variations in procedure, legitimate differences in interpretation, etc.

Often a common class investigation leads to suggestions from the children or teacher for further investigation. These can provide opportunity for individuals or small groups to do further work at home or at school.

Open ended elementary science provides for:

a. closure on the child's terms

b. creativity and divergence

c. individual differences

Examples of teacher reactions which support strategy #6:

1. Try it and see what happens.

2. Can you think of anything you can do to find out?

3. Child: "Why does it do that?"
Teacher: "What did you have to do to make it happen?"

4. Can you think of anything else we can try to find out more about it?

5. Is there anything you might investigate at home that is related to what we have been doing?

6. Jimmie, you thought of another question while you were working on this investigation. You might want to do some investigating on your own and let us know what you find out.

OPEN EDUCATION

The philosophy of Science Unlimited is quite compatible with that of open education. The televised programs are developed for large group instruction, but the follow-up activities accommodate *groups* of many sizes.

Children are *directly involved* with the materials of their environment at the same time that they are involved *socially* with each other and adults, both professionals and paraprofessionsla.

The openness of many investigations provides the child with *choice* as to questions tested and materials used. Thus, investigations are designed to be *self-motivating*.

Cooperative teaching required in such innovations as the non-graded plan and continous progress supports the intent of Science Unlimited. The large blocks of a daily timetable required in cooperative teaching and the *correlation* of various subjects is the sort of plan that enhances the aims of Science Unlimited.

CORRELATION: A TIME SAVER

An on-going science program in the elementary classroom requires its own spot in the dialy timetable and at the same time must be able to correlate with other subjects. Science Unlimited was developed with this thought in mind. For example, *Investigating Thermometers* and *Investigating Measurement* are math-centered. *Investigating Dripping Faucets*, an ecologically oriented lesson, would correlate well with social studies, along with language when the children write a story. *Investigating Eyes* is a health lesson.

Other Science Unlimited lessons are especially appropriate for learning centers and still other encourage open-ended investigative activities that children can do independently - some out-of-class, at home activities.

Characteristics of Science Unlimited Lessons:

A Summary Sheet

INVESTIGATING:

- Drops
- Mystery Boxes
- Observation and Description
- Measurement
- THE THERMOMETER
- EYES
- SALT AND WATER
- SIPHONS
- DRIPPING FAUCETS
- REFLECTION OF LIGHT BEAMS
- FLOATING THINGS
- ICE AND WATER
- THINGS THAT MAGNIFY
- FRICTION
- PROBLEMS OF SPROUTING SEEDS
- HEAT LOSS
- BOUNCING OBJECTS
- STRIPS AND LIQUIDS
- SOUND
- EVAPORATION

PRIMARY LESSON

INVESTIGATING DRIPPING FAUCETS

COMPETENCIES

A. Processes

1. Observing
4. Predicting
5. Measuring
6. Communicating
12. Interpreting Data

B. Biological Science

1. Characterisitics of Living Things
6. Ecology

C. Physical Science

1. B. Water

D. Earth and Space

4. Natural Resources
5. Weather and Climate

E. Attitudes

3. Towards Personal Use of Science
5. Towards Science and Society

LESSONS

Lesson 1 - Activity 2: Children predict and measure amount of water wasted from a dripping faucet during one hour.

Lesson 2 - Activity 1: Prior to Science Unlimited Tape entitled Investigating Dripping Faucets, children should discuss uses and wastes of water.

Lesson 3 - ITV Video Module in Investigating Dripping Faucets. Forty-five minute presentation. See Attachment.

Lesson 4 - Activity 3A: Children collect water from a dripping faucet over a day long period of time.

Lesson 5 - Activity 4: Children use the water collected the day before to water flowers, fill aquaria, etc., to show possible uses of wasted water and design a measuring system.

Lesson 6 - Activity I: Students use several jars of water and soil to demonstrate differnt levels of "polluted" water, observe them, and order them in rank in terms of "pollution."

Lesson 7 - Activity Competency Measure, V: The children and teacher work together to develop a composite story of their science activity.

DRIPPING FAUCETS

PRIMARY

"Investigating Dripping Faucets," Science Unlimited Video Tape, P, 15 minutes: The lesson centers on a dripping faucet. In addition to arousing a consciousness of the fact that water is a valuable resource and must be conserved, methods are use to involve viewers in science processes such as observing, communicating, measuring, and interpreting data.

"Water Follies," All Ages, 7 minutes, color: Fantastic Film. Through animation, shows the need for water conservation. Emphasizes ways everyone can do their part. S/P Associates (Stan Phillips and Associates Films), P.O. Box 5268, Term Annex, Denver, CO, 80217.

"Water," AEBC, Natural Science 1st Films, P, 10 minutes, color, 1983: Water covers much of our earth, and there is even water in the air. Where there is little water, the land is a desert, for plants and most animals cannot live without water. Water appears in several forms, including rain, snow, ice, and clouds.

"Water - A First Film," BFA, P, I, 9½ minutes, color, 1968: Water is an important part of our world. Without it nothing can live. We drink it, cook with it, water our lawns and gardens with it, and fight fires with it. Understanding the importance of water and its uses, as well as how to avoid misusing it, are important primary and elementary concepts.

OTHER

"Water Purification," Aims, P, M, 9 minutes, color, 1970: An introduction to the study of our most vital resource, water and the process of purifying it for our use in the community. Simple demonstrations explain purification. A useful film for conservation.

"Water Pollution - A First Film," BFA, P, I, 8 minutes, color, 1971: Pure water is necessary for life, but many things contribute to water pollution. Following a single stream from its origin to its end, reveals many sources of pollution. Individuals as well as groups can help clean up our water resources.

"I Like Water," Aims, Pre-Pri., 8 minutes, 1970: We see the importance of water to all living things. The many forms and colors of water are explained in simple terms of stimulate an understanding of our needs and the beauty of various water areas, rivers, lakes, ponds, fogs, oceans, and rain.

"The Water Film," Barr Films, 8½ minutes, color, 1977: A search for water brings Herman, a curious young rabbit to a brook where the water begins talking. She tells him that she has many forms as the seasons change. Herman sees them all, streams, rivers, the ocean, mist, clouds, rain, and ice. Herman learns that water is always around us and that it will always be around us, but only if we take care of it.

INVESTIGATING THE DRIPPING FAUCET

Television Introduction

Teacher Orientation

This introduction is designed to provide a transition into the "science activities" which you will conduct following it. You will probably want to spread the Science Unlimited lesson activities over several days. Emphasis in this television presentation will be placed upon introducing basic concepts and techniques leading to student instructional objectives as well as techniques that you may use to promote these desired objectives.

The lesson centers around a dripping faucet. In addition to arousing a consciousness of the fact that water is a valuable resource and must be conserved, methods are used to involve viewers in science processes such as observing, communicating, measuring and interpreting data.

The televised program is initiated with a brief scene of a city water treatment plant. The narrator uses such words as "community," "purified," "water treatment" and "reservoir" so the teacher would be expected to use her own judgment in how she prepares the children for this vocabulary.

The children are expected to count by ones to 50 and to write the numbers. Although the follow-up Science Unlimited lessons require some equipment, the televised program requires no equipment.

The science concepts for which this Science Unlimited lesson serves as a readiness experience are: water, conservation, time and gravity. However, these terms are not narrated in the televised program. On eight occasions during this television program, questions are posed and time provided for discussion in the classroom. The charts on the next page indicate the length of the discussion periods, questions raised and suggested strategies which may be followed:

SCIENCE UNLIMITED: INVESTIGATING THE DRIPPING FAUCET (color)

Discussion Period and Time	TV Image	Final Broadcast Statement	Suggested Statement or Questions	Teaching Strategy
1 1 min.	Water dripping from faucet	Suppose you take a minute to talk about what you see happening.	What do you see?...Where do you think the water is going? Can you give us the reason for your answer?	Open[6] Ended
2 approx. 2 min.	Closeup of drain, then film showing	Take a few minutes to watch carefully and tell the ways you see water is being used.	Look closely at the TV and tell us what ways you see.	Process[5] Observation & Communication
3 & 4 1 min. 1 min.	Dripping faucet and stop watch	Are you ready? Start counting.	(Count drops aloud with student.)	Process[5] Measurement
5 30 sec.	A question-mark over both faucets	Which of these faucets wasted the most water and why?	What did you observe that helped you decide?	Answer[2] Evidence
6 approx. 3 min.	Closeup of two faucets, then film showing ways water is wasted	...tell other ways you see in which water is being wasted.	Watch closely. When is water running but not being used? When is he using water, and when is he wasting it?	Answer[2] Evidence

Title: Investigating Dripping Faucets

Level: Primary

Aims:

1. Students will measure with English units to solve problems concerning volume and time.
2. The students will work as a group to solve problems by gathering information, using materials, observing purposefully and drawing conclusions based on these findings.
3. The students will demonstrate competency in use of processes of science by (a) observing (b) measuring (c) inferring (d) predicting.

Instructional Objectives:

At the conclusion of this lesson the students will be able to:

1. Describe verbally several uses they have for water.
2. Count the drops from a faucet.
3. Estimate, but with limited precision, the amount of water a faucet will drip in one hour.
4. Measure the amount of water dripped in one hour (one school day).
5. Measure and pour six "hour units" in a large container -- water wasted in one school day. (Upper primary grades)
6. Manipulate the hands of a handmade clock simulating 9:00, 10:00, 11:00, 12:00, 1:00, 2:00 and 3:00 at the same time that "hourly units" of water are poured into a large container. (Upper primary grades)
7. Dictate a story to the teacher describing accurately the science activity.

Background Information

Water allowed to drip from a faucet over a period of time amounts to a quantity of wasted water that is far greater than usually estimated by the young student. This experience can sensitize the student to the large quantity of water a dripping faucet can waste in one day.

The activity does require a faucet either in the classroom, school rest room, or outside the building. The teacher and students may need to spend some time adjusting the school faucet so that it drips in a regular fashion.

Activity IIIA is suggested for lower primary grades and Activity IIIB for the upper primary child. The alternatives are suggested because of the time element involved. Children who know the basic rudiments of telling time can handle Activity IIIB. Older primary children could complete both Activity IIIA and IIIB and compare their results.

Equipment

A classroom group will need: a faucet, a clock, a thimble (or small lid), a small baby food jar, a cup, a quart jar, an aquarium or four or five gallon plastic milk bottles, a funnel and a large rubber band (to mark water level).

If you choose to do Activity IIIA, you will need one large bucket. If you do Activity IIIB, each child will need a homemade clock face - perhaps a "paper plate clock" (a paper plate with a clock face drawn on it and moveable hands.)

Activity I - Readiness

1. Younger children might be asked to cite verbally several uses they have for water. (Wash hands. Brush teeth. Drink it. Swim in it.)

2. Ask them to describe a dripping faucet (or spigot). Where does the water go? Is it wasted? If it is wasted, can they drink it? Brush their teeth with it?

3. How many of you have seen dripping faucets at home? Is the water wasted?

Activity II

1. Discuss with the children their concept of an hour. Two children's TV programs each a half hour long could equal an hour. A Disney TV program could be the equivalent of one hour. Three recess periods. The time period between lunch and music, etc. Ask the children to simulate on hour on the clock as one revolution of the minute hand on the classroom clock or homemade clock faces made by children.

2. Ask them to estimate how much water a dripping faucet will waste in one hour. At the same time, hold up a thimble for children to see (or small lid), a baby food jar, a cup and a quart jar.

3. Print the following on the blackboard and tally the estimates of the whole class.

   one thimble
   one small baby food jar
   one cup
   one large (quart) jar
   more than one large jar

4. Collect the water wasted by the dripping faucet in one hour and determine which group estimated most accurately.

Activity IIIA - (lower primary grades)

Place a bucket under the dripping faucet, when the school day begins, and collect the water wasted by the faucet from 9:00 to 3:00, one school day.

Activity IIIB - (upper primary grades)

Place a large container/aquarium, several gallon plastic milk bottles, etc. on a table and prepare to pour in the large container the amount of water that is wasted in one school day.

Ask each child to place his clock hands on 9:00. As each child moves the hour hand round one whole turn and places the short hand on 10, ask one child to pour in the large container the water that dripped in one hour.

The container is placed under the faucet and filled (not dripped) to the one-hour mark. As each child simulates another hour on his clock, another "hour's worth" of water is poured into the large container.

This procedure is continued for 12:00, 1:00, 2:00 and 3:00 at which point children observe closely the amount of water a dripping faucet would waste in one school day.

Activity IV

Use the water wasted by the dripping faucet in one day to water school flowers, wash hands, replenish the aquarium. Record the use that was made of the water that would otherwise be wasted, i.e., 30 children's hands, 15 school plants, etc.

Activity V - Competency Measure

As the students in the group dictate orally the procedure and findings of their science activity, the teacher will print the class' composite story on the chalkboard or large sheet of paper. The students will be asked to check their story closely to see that it is accurate.

Title: Investigating Water Filtration (Gary A. Miller, William P. Bradley)

Level: Intermediate

Aims: From Science Unlimited Toward Which This Lesson Contributes:

1. The student will solve problems by gathering information, working independently, using equipment and materials, observing purposefully and drawing appropriate conclusions based on these findings.
2. The student will demonstrate competency in the use of the processes of science by: (a) observing, (b) classifying, (c) measuring, (d) inferring, (e) controlling variables, (f) interpreting data, (g) experimenting, (h) ordering, and (i) predicting.
3. The student will demonstrate a desire to learn and a curiosity for the unknown by formulating and performing self-motivated investigations.
4. The student will defend a point of view by making use of supporting evidence.

Instructional Objectives: At the conclusion of this lesson, the students will:

1. Order liquids according to different stages of muddy water.
2. Predict different ways to purify dirty water.
3. Control variables to test an inference about two filtering systems.
4. Design an investigation to test a self-made hypothesis.
5. Draw and label a diagram of an effective filtering system.

Background Information:

This lesson is designed to give children experience in observing and interpreting data. From the data collected, students make inferences and set up investigations to test these inferences.

Water has a unique cycle that is explained to children from K-12. However, within this cycle, humans must intervene to help purify water for human use. This is commonly done by passing the water through beds of sand or charcoal.

Instead of just explaining to the students the materials that should be used to filter water, this lesson allows the students to try different materials and design a water purification system. Materials that are in the environment of the children are used throughout the investigation.

It is important that children realize that simply filtering water does not free it of bacteria, so it certainly should not be considered safe for drinking.

Total Equipment List for a Class of 25-30 Pupils:

14 Flower pots
13 Paper bowls
14 Large paper cups
3 Jars
Water
Gravel
Soil
Shale (large and small)
Paper towels
Paper

Activity I - Readiness Activity (Aim 2)

Materials Needed: Three jars, soil, water

Show several jars of liquids demonstrating various stages of cloudy, muddy water. Have the children observe the jars and list the various observations they make. Shake up the liquid. Order the liquids from most polluted to least polluted. (Obj. 1)

Discuss the various observations they make and discuss possible solutions to cleaning the water. (Obj. 2)

Activity II - (Aims 1 & 2)

Materials Needed: Flower pots, bowls, large shale, sand, paper cups, water, paper, soil

Provide each group of three or four children with two flower pots, placing a 2-inch layer of sand in one and a 2-inch layer of shale in the other. The students should make two solutions of dirty water in the paper cups. This can be accomplished by placing 1 inch of dirt in the bottom of the cup and filling the cup with water while mixing it. Controlling variables is essential and the students should be careful to make both solutions exactly the same. (Obj. 3)

Now, the solution can be poured through the different filters, placing the paper bowl below the flower pot to catch the run-off of water. If more muddy water is needed, the students can repeat the above process.

Observations of the water in the bowls should lead the students into a discussion as to which filtering substance seemed to clean the water best.

Characteristics of the best system should be written on a piece of paper by the group. This list can be changed or added to, as the investigations continue.

Activity III - (Aims 3 & 2) (Obj. 4)

Materials Needed: All materials on the total equipment list plus any needed by each group in independent investigations

PRIMARY LESSON

INVESTIGATING CLASSIFICATION/SORTING

COMPETENCIES

A. Processes

1. Observing
2. Classifying
3. Communicating

C. Physical Science

1. A. Matter: Form/State
1. C. Matter: Elements

E. Attitudes

1. Toward Classwork
3. Toward Personal Use of Science
4. Toward Oneself

LESSONS

Lesson 1 - Activities I, II, III, IV, and V, "Investigating Sorting," by Roy W. Allison and Margaret Petroskie. Children will describe and sort objects by color, size, and shape.

Lesson 2 - Video Module on Investigating Classification/Sorting. Forty-five minute presentation. See attachment.

Lesson 3 - Activity I, "Investigating Classification Methods," by Roy W. Allison. Discovering the presence of a marble is the focus of this lesson. Children suggest and investigate ways for finding out which containers have marbles in them.

Lesson 4 - Activities II, III, and IV, "Investigating Classification Methods," by Roy W. Allison: Children investigate various "Look-alikes"--vinegar and water, a porous rock and a sponge, and pieces of metal and wood--finding ways to distinguish them from each other.

Lesson 5 - Activity V, "Investigating Classification Methods," by Roy W. Allison. In a whole class activity, triangles, circles, and squares are lined up and the class is challenged to design and identify different groupings.

Lesson 6 - Competency Measure, "Investigating Classification Methods," by Roy W. Allision. Each child collects 10 different items from the school yard and separates them into two groups on the basis of some property, e.g., size, color, hardness, texture.

CLASSIFICATION/SORTING

PRIMARY

"Observing and Classifying," AIT, Hands on Series, P, 15 minutes, color, 1975.

"Size, Shape, Color, Texture," (Repeat of Observation and Description, Primary), AIT, Hands On Series, P, 15 minutes, color, 1975.

"Classifying Objects," AIT, Hands On Series, P, 15 minutes, color, 1975.

Title: Investigating Classification Methods (Roy W. Allison)

Level: Primary

Aims: Toward Which This Lesson Contributes

1. The student will demonstrate competency in the use of the processes of science by (a) observing, (b) classifying, (c) communicating.

2. The student will defend a point of view by making use of supporting evidence.

Instructional Objectives: At the conclusion of this lesson the student will be able to:

1. Identify objects on the basis of color, size, shape, texture, and hardness.

2. Classify objects on the basis of a single characteristic he/she chooses and defend this classification.

3. Identify the characteristic by which someone else has classified a collection of objects.

BACKGROUND INFORMATION

Teachers of children in the early primary grades should provide as many opportunities as possible for these children to have concrete manipulative experiences. The more experiences we can provide for young children to develop their senses and to communicate these sensory experiences to others the more we are helping them to learn.

The children should be given experiences which will help them make observations needed to classify objects. Teachers should help the students develop language skills to communicate differences in color, size, shape, texture, and hardness as well as other sensory experiences.

This lesson could be taught at any time of the year. The children should, however, be given the opportunity to collect a number of items in the school yard to be classified. Each child should be given the opportunity to make a collection. The principal may even be pleased to get the school year "picked up." The children should be cautioned to handle the things they pick up with care to avoid being cut with broken glass or other sharp materials.

Total Equipment for a Class of Approximately 30

30	plastic bags to hold collections
2	clear plastic pill bottles with lids for each group
2	35mm plastic film containers with lids for each group
2	look-alike items, one hard and one soft, for each group
2	look-alike items, one wood and one metal, for each group

1 marble for each group
water
vinegar
1 container half filled with water for floating or sinking experiments
6 large triangles in red, orange, yellow, green, blue, and violet
6 small triangles in red, orange, yellow, green, blue, and violet
6 large circles in red, orange, yellow, green, blue, and violet
6 small circles in red, orange, yellow, green, blue, and violet
6 small squares in red, orange, yellow, green, blue, and violet
1 roll masking tape

Activity I

Materials needed: 2 35mm plastic film containers
1 marble
masking tape for each group

Have one child from each group place a marble in one of the containers out of sight of the group. Ask the group to tell how they could discover which container held the marble. Have them try the method they agree upon and see if they discover which container holds the marble. If the group is correct then another child in the group may hide the marble until each child has taken a turn at hiding the marble and/or discovering which container has the marble.

Children could detect the presence of the marble because the container it is in would be heavier. Other children would detect the marble's presence by shaking the containers to see which container made a noise. A third way might be to try floating both containers and the one which floated lower or sank was the one which contains the marble. Are other ways possible?

Do not attempt to lead them to one discovery or another. But rather encourage them to find as many ways they can to determine the difference.

Have students communicate any new (to the students) ways of telling them apart so that the class could try this method.

Activity II

Materials needed: one pill bottle--half filled with white vinegar
one pill bottle--half filled with water for each group

Tell the children one container has vinegar in it, the other has water. Ask them, "Which container has vinegar?"

Some will suggest you taste each. Others may suggest you smell each.

This would be a good time to teach the proper method of smelling unknown materials. Never bring a vial of unknown up to your nose to smell it. Always fan the air from the vial toward you nose with your hand. The teacher should demonstrate this to the children.

Tasting unknowns in classrooms should not be encouraged either, unless sanitary precautions are taken such as a clean, separate tasting device for each taste. No device to be returned to the material being tasted after the device has been used by one individual.

Activity III

Materials Needed: 2 look-alike items--one hard and one soft for each
group. (a porous rock and a sponge each painted
the same color will do)

Tell the children one of these materials is soft the other is hard. Then ask "How can you tell which one is hard?"

Activity IV

Materials Needed: 2 look-alike items--one wood and one metal for each group. (both could be cut to the same size and painted the same color)

Tell the students one of these materials is wood and one is metal. Ask them to distinguish between them.

They could try putting them both in water since the chances are the wood would float and the metal would sink.

They could say the wood is light and the metal heavy if they lifted them.

They could even try a magnet in the event and metal would be iron, but this is just a chance.

They could even tap them to hear a metallic ring from one of the items.

Encourage the children to find as many ways to tell the two apart as they can. Have the students communicate new ways (their discoveries) they find with their classmates.

Activity V

Materials Needed: 6 small and 6 large triangles, 6 small and 6 large circles, and 6 small and 6 large squares

This is a whole class activity. Line up the 36 shapes and ask who can find a way to group these figures in a way that all the figures in at least one group are alike in some way. Ask for a volunteer to make this separation.

Now ask the class to identify the reason for the separation. When the class agrees then ask the student who made the separation if that was his reason. If he agrees then put the objects together and ask for another way to separate them.

The possible ways are by: shape, color, size, and by any combination of these three.

Activity VI - Competency Measure

Materials Needed: A plastic collection bag for each child

Instruct each child to collect at least 10 different items while outside on the school yard. When you return to the classroom have the children empty their treasures on their desk. Ask each child to separate their collection into two groups of items which belong together for some reason.

If you have done your job well in this lesson they will classify items by physical properties of the items such as size, color, hardness, shape, texture, weight, and so forth.

Title: Investigating Sorting (Roy W. Allison and Margaret Petroskie)

Level: Early Primary

Aims: Toward Which This Lesson Contributes

1. The student will solve problems by gathering information, working independently, using equipment and materials, observing purposefully and drawing appropriate conclusions based on their findings.

2. The student will demonstrate competency in the use of the processes of science by: (a) observing, (b) classifying, (c) communicating, and (d) ordering.

Instrucational Objectives: At the conclusion of this lesson the students will be able to:

1. Describe an object by the physical properties of color, shape, and size.

2. Sort objects by color, shape, or size to form sets.

3. Identify and state the reason a classmate is using to sort objects.

BACKGROUND INFORMATION

A teacher needs to present and stress "hands-on" concrete manipulative science activities in all grades as a means of facilitating thinking among the students. Teachers can, however, facilitate and enhance mental growth through providing activities where the student mentally acts on what is being learned. This means there needs to be a shift from the traditional approach of a teacher as a teller and the student as the receiver to the teacher as the facilitator and the student as the actor and doer. To Piaget, there is no learning without action, and action to him includes being physically, mentally, and socially involved, rather than simply listening.

Figure 1 may be used as a pattern to make the materials needed in this lesson plan by making a spirit master of it and then running if off onto construction paper in black, yellow, orange, red, and green. The construction paper pattern may be glued or rubber cemented to some thin cardboard or file folders to make the shpes more sturdy. Then glue or rubber cement the same color construction paper on the reverse side of the cardboard, so that both sides of the figures will be the same color. You should make enough shapes so that each child could have one shape to hold at the beginning of this lesson. When your construction paper-cardboard-construction paper "sandwich" dries, cut out the shapes.

Prepare a grocery bag for each color and/or each shape used. You could use the scraps from cutting out the shapes to make color names for each color used by cutting letters from the scraps and gluing the letters on the grocery bag. You could also cut a shape for each bag to be used to collect shapes and glue the shape to the bag.

Total Equipment List

2 large triangles
2 small triangles
2 large squares
2 small squares
2 large circles
2 small circles
2 large rectangles
2 small rectangles
1 grocery bag for each color used with color name on it
a collection of other objects from the classroom or home in the same colors as the shapes above

these shapes should be made in colors as suggested in the Background Information

Activity I - Sorting by Color

Materials Needed: one large object for each child from the shapes made and the grocery bags with color names on them.

Distribute the large shapes so that each student will have an object. The teacher could hold up one of the objects and ask all students with this color object to stand and hold their objects above their heads. The teacher could then ask (1) "What color are the objects held by the students who are standing?" (2) "What bag has the color name of these objects?" Have the students place their objects in the proper color bag. Repeat these procedures for each color until all objects are in a color bag.

Then dump the contents of each bag onto the floor one bag at a time and in a distinctly different area. As each bag is dumped the teacher should ask "How are these objects alike?" The students should respond that they are the same color and identify the color correctly.

Activity II - Sorting by Shape

Materials Needed: One large object for each child from the shapes made. (The same objects used in Activity I) The grocery bags with shapes glued on them.

Distribute the large shapes so that each student has an object. The teacher could hold up one of the shapes and say, "Anyone who has an object shaped like this please stand up and hold the object above your head." Then the teacher could ask, "What is the shape of these objects?" After the students identify the shape a discussion could follow giving some way to identify shapes like the ones being held up.

Have the students place their objects in the proper shaped bag. Repeat these procedures for each shape until all objects are in a shape bag.

Dump the contents of each bag onto the floor, one bag at a time, and in a distinctly different area. As each bag is dumped, the teacher should ask "How are these objects alike?" The students should respond that they are the same shape and identify the shape correctly.

Activity III - Sorting by Size

Materials Needed: All the shapes prepared.

Distribute all the shapes so that each student will have at least one large and one small object of different shape. When all of the students have a large shape and a small shape the teacher could say "Please hold the large shapes above your head." Have one of the students collect the large shapes and place them in a pile on the floor. When this is one the teacher could ask "How are these shapes alike?" Then ask the students "How are the shapes we have in our hands alike?" They should respond that they are all small. collect these and mix them with the large objects.

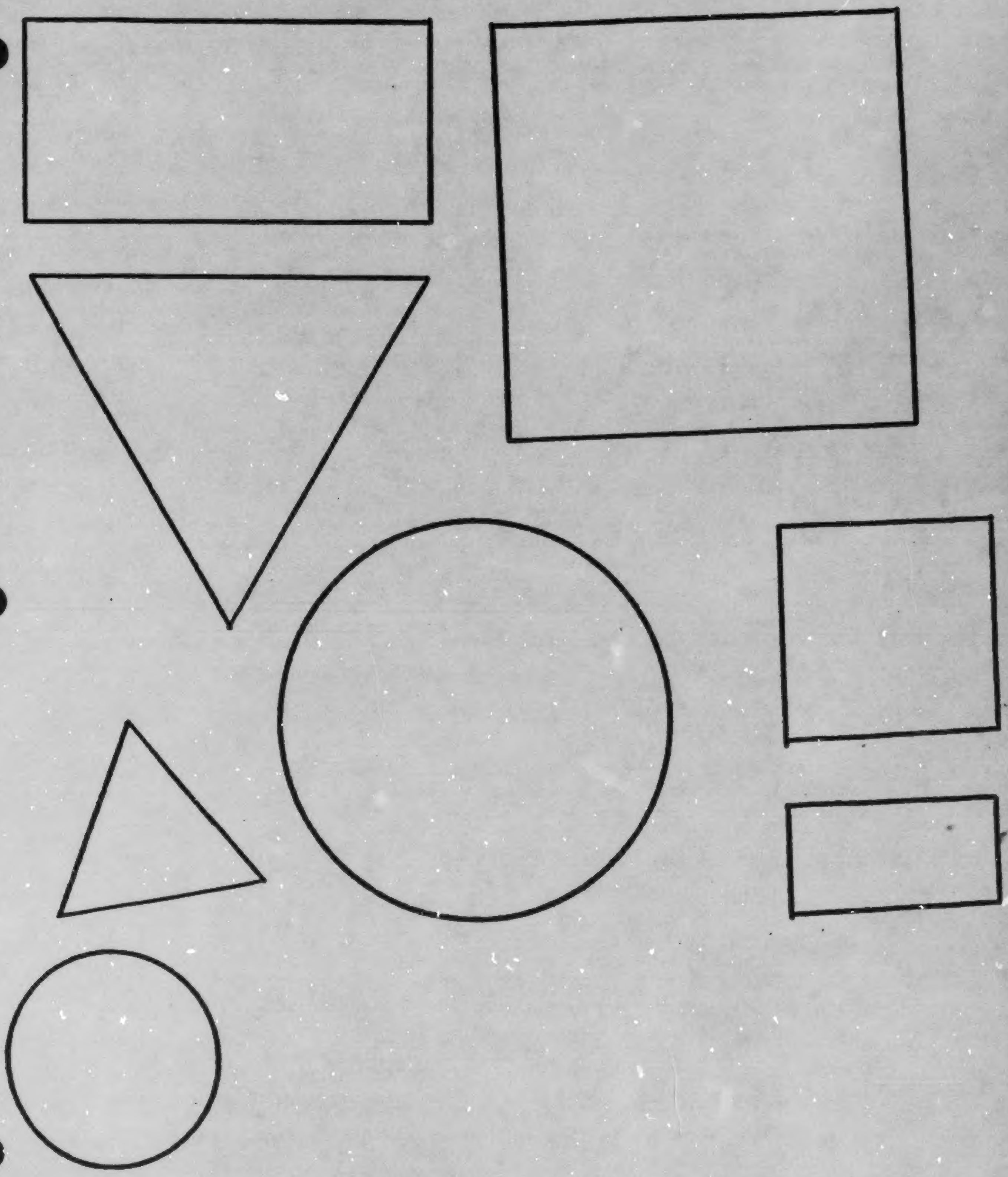
Activity IV

Place assorted shapes along the chalkboard tray and ask "Who can find the large red square?" Have a student go to the chalkboard tray and find and hold up the large red square. The teacher could ask the class, "Is this a large red square?" If the student holding the object is correct, that student may remain standing while holding the large red square. The teacher could continue naming each of the shapes displayed until each student has correctly identified one of the shapes.

Activity V - Competency Measure

The students could each be given a shape and asked to line up along the side of the room. The teacher could ask "Who can describe the shape they now hold?" As each class member describes the shape they hold ask the class "Is this a _______?" If the student is correct and the class agrees, have them place their shape along the chalkboard and sit down. Continue until all classmembers are seated. If any classmember has difficulty ask "Who can help _____ describe this shape?"

Figure 1



PRIMARY LESSON

INVESTIGATING SMELL (pre-school)

COMPETENCIES

A. Processes

1. Observing
2. Classifying
3. Inferring
4. Predicting
6. Communicating
10. Experimenting

B. Biological Science

5. Human Biology

E. Attitudes

1. Toward Classwork
3. Toward Personal Use of Science
4. Toward Oneself

LESSONS

Lesson 1 - Activity I, Readiness Survey, INVESTIGATING SMELLS: Children talk about their noses and sense of smell while looking at a "nose collage" and a "smell collage."

Lesson 2 - ITV Video Module on Investigating Smells. Forty-five minute presentation. See attachment.

Lesson 3 - Activity II, INVESTIGATING SMELLS: Children identify food items by smell and match them with a correct identifying picture. They also learn to use a correct smelling technique.

Lesson 4 - Activity III, INVESTIGATING SMELLS: With eyes closed, children identify the smells used in Lesson 3.

Lesson 5 - Activity IV, INVESTIGATING SMELLS: In small groups, children are asked to identify food items that have been placed in foil covered jars.

Lesson 6 - Activity V, INVESTIGATING SMELLS: A center is set up by the teacher where children can go throughout the day to smell objects.

Lesson 7 - Activity VI (optional), INVESTIGATING SMELLS: The children and teachers read and discuss the book Whose Nose Is This?

Lesson 8 - Activity VII, INVESTIGATING SMELLS: Children become more aware of smells around them by smelling a snack and the air around them.

Lesson 9 - Competency Measure, INVESTIGATING SMELLS: Children are asked to identify smells used in Lessons 3-5 and match them with correct pictures.

Lesson 10 - Optional Activity, INVESTIGATING SMELLS: Making collages, smell jars, cooking food, and organizaing a smell learning center are suggested for further work with the sense of smell.

SMELL

PRIMARY

"Taste and Smell," 3-2-1 Contact, P, 30 minutes, color.

"The Sensational 5: The Inside Story of Your Five Senses," AIT, P, 15 minutes, color, 1981: Slim uses models to show how the eye, ear, nose, mouth, and skin work with the brain to keep us in touch with the world.

OTHER

"Learning to Use Your Senses," EBEC, P, 11 minutes, color, 1971: Encourages children to verbalize sensory perceptions. Points out that people use their five senses automatically, and explains how to learn about the environment by using the five senses. (Repeat of Description and Observation, Primary).

"Learning With Your Senses," Cort, P, 10 minutes, color, 1968: A family outing at the beach is the setting for this film which encourages youngsters to use the five senses together, and individually to learn more about the world around them. Shows how each sense gives different kinds of information.

Title: Investigating Smells (Cindy Frysinger and Roy W. Allison)

Level: Primary (pre-school)

Aims:

1. The student will solve problems by using materials, observing purposefully and drawing appropriate conclusions based on these findings.

2. The student will demonstrate competency in the use of the processes of science by: (a) observing, (b) classifying, (c) communicationg, (d) inferring, (e) experimenting and (f) predicting.

3. The student will discriminate between evidence and proof, observation and inference.

4. The student will demonstrate a desire to learn and a curiosity for the unknown by performing self-motivated investigations.

5. The student will defend a point of view by making use of supporting evidence.

Instructional Objectives: At the conclusion of this lesson the student will be able to:

1. State basic functions of the nose.

2. Recognize those smells that were part of class activities.

3. Match "smell jars" with the appropriate picture of the object producing the smell.

4. Voluntarily examine and smell the articles on the "smell table."

5. Show he/she is more aware of smells in his/her environment.

BACKGROUND INFORMATION

Senses of smell and taste are based on a sensitivity to chemicals. Often the smell of food makes it taste better. (If you hold your nose, you sometimes can't taste what you're eating.) If food smels bad, it may be a warning that it is spoiled. Colds or illness can hamper a child's sense of smell. Some children can be born without a sense of smell. (The olfactory nerve endings in their nose do not develop properly.) These children also have a poor sense of taste.

Please, do not permit children to smell by putting their nose directly over or into any container. They should waft to smell. This is done by holding the object being smelled several inches away from their nose and "pulling" the smell toward their nose with their hand.

Smell Jars: Small jars containing small amounts/pieces of objects to be smelled. These jars should be completely covered, so children can't peek, and should have holes punched in the top to allow the odor to escape. (A kleenex wrapped up from the bottom and secured around the neck with a rubber band works well for baby food jars.) Aluminum foil may be used for lids, secured by a rubber band to prevent peeking. Cardboard containers, such as frozen orange juice containers with aluminum foil lids work well, are already opaque and are safer to use than glass jars.

Smell Table: This could be any small table with a collection of objects the children may "smell" at their leisure. Some objects included were: coffee, dirt, crumpled newspaper, and assorted smelly objects that children would easily recognize.

Collages: Two collages stimulate interest by using poster board and magazine cut outs. Pictures of noses makes an interesting collage and can generate discussion. Pictures of objects which produce odors the students easily recognize could be used to make a second collage.

Picture cards: A picture of objects which produce odor (onion, apple, orange, and others) glued upon individual index cards with the name of the object printed beneath each picture.

The lesson will take approximately 30 minutes. The competency measure is completed the following day.

Total Equipment List:

8 baby food jars
kleenex (to wrap jars and to make lids)
aluminum foil
rubber bands (to secure lids)
2 onions
2 lemons
2 oranges
2 apples
jar of peanut butter
2 pieces peppermint candy (peppermint extract and cotton ball if you feel you need a stronger scent)
jar of pickles
chocolate chips
scented candle
flowers (around room to add nice odors)
shoe box
1 picture of each, pasted separately on an index card: onion, lemon, orange, apple, peanut butter, chocolate, peppermint candy, pickle. (name to correspond with picture should be printed clearly on each.)
library book: Whose Nose Is This? by Dr. Richard VanGelder
collage of noses (tag board, glue scissors, old magazines.....)
collage of smells (tag board, glue scissors, old magazines.....)
evergreen branch

bar of soap
piece of wood, with fresh saw cut
pine cone
newspaper
coffee
dry leaves
dirt
piece of construction paper

This equipment list was used for approximately 20 children.

Activity I - Readiness Survey:

1. Materials:

nose collage smell collage	Note: Have candle burning, in safe place, and flowers on the tables...

2. The class will gather in a circle to discuss THE NOSE.

3. The teacher will:

- show collage of noses - What are these? Is there one here that looks like yours?
- How do we use our noses? (smell, breath, blow!) Practice taking deep breaths.
- we learn about things by how they smell, taste, feel, look...
- some things smell good, some not so good. Show collage on smell how do these things smell?
- we can tell some foods by how they smell - sometimes we can tell what we're going to have to eat by how it smells...examples?

(Post collages where they can be looked at throughout the day.)

Activity II:

1. Materials

2 onions, one cut
2 lemons, one cut
2 oranges, one cut
2 apples, one cut
jar of peanut butter-with some in a smaller container to pass if you wish
2 pieces of peppermint candy, one unwrapped
jar of pickles-with some in smaller containers to pass if you wish
bag of chocolate chips-with some in smaller containers to pass...

Picture cards - index cards (8) each with one picture of the following: onion, apple, orange, lemon, chocolate, pickle, peppermint candy, peanut butter. (name printed on each)

2. While sitting in a circle the students will be asked to identify the above items, one at a time. They will then be passed around - (the cut items) - for all to smell. (Note Smelling Technique)

3. Teacher will ask students to identify the objects. Does anyone remember smelling this before? Where? Picture cards are introduced here so the students can associate them with the appropriate object later. Stress that we are smelling, not tasting?

Activity III:

1. Materials (From Activity II)

   cut piece of lemon
   cut piece of apple
   cut piece of orange
   cut piece of onion
   peanut butter
   pickles
   piece of peppermint candy
   chocolate chips

2. Students, with eyes closed, will be asked to identify what they are smelling.

3. Teacher will go around the circle, holding up different jars to each childs' nose and having them guess what they're smelling.

Activity IV:

1. Materials:

   8 baby food jars
   kleenex
   aluminum foil (to wrap jars and to make lids)
   rubber bands (to secure lids)
   piece of lemon
   piece of orange
   piece of apple
   piece of onion
   piece of peppermint candy (perhaps some peppermint extract on a cotton ball if the smell needs to be stronger)
   peanut butter
   pickles
   chocolate chips

2. Children will return to tables. Each group will be given two small jars to smell. The children will smell the jars and discuss among themselves what smells they have smelled. When they think they know, they will raise their hands.

3. Jars are assembled by placing a piece of the object to be smelled in each jar. A small piece of foil is fit snugly over the top. A kleenex is wrapped up from the bottom (covering the bottom to protect against peeking) to the neck of the jar. A rubber band around the neck holds the kleenex and foil in place. Several holes are punched in the top with a pencil point to enable smelling. Teacher encourages all to smell the jars and discuss what they smelled. As children raise their hands and respond, allow one child to go and bring the object (from the circle area) and let them compare the smell. They are then verifying their own opinions. Hopefully, time will permit each table to try all 8 jars. (In the time given in the beginning of the plan, time was alloted for only one set of jars per table.)

Activity V

1. Materials:

   evergreen branch
   bar of soap
   piece of wood, with fresh saw cut
   pine cone
   newspaper, crumpled
   coffee, dry
   dry leaves
   dirt
   any other objects the teacher would like...

2. This is an ongoing activity throughout the day. Children can come to the table and smell the objects at their leisure.

3. The teacher should point out and encourage the use of the table. Explain as needed that the sign says smell, that we are to smell the things...

Activity VI: Optional

1. Materials: Whose Nose Is This? by Dr. Richard VanGelder (or any library book about the nose that the teacher may choose.)

2. This is a participation book where the children guess whose nose they're looking at. Clues are given.

3. The teacher reads books and encourages as much participation as possible.

Activity VII:

1. Materials: a snack

2. Children become more aware of smells around them by smelling their snack; noticing how the air smells outside, in the halls, in the bathrooms, in ohter areas of the school.

3. Throughout the day, the children are encouraged to smell items around the classroom and halls they are near. Observe how much is done without teacher prompting.

Last Activity * Competency Measure (This is to be done the following day)

1. Materials:

    smell jars already assembled from the day before in a shoe box, 8 pictures on index cards, used the previous day.

2. The child will be able to recognize the smells used the previous day and match them to the appropriate picture. He/she will be able to state two functions of the nose.

3. The teacher will begin by having the child come to him/her individually. The picture cards are to be laid out on the table, facing the child. Ask the child to review by telling what each picture is. Then instruct the child to smell each jar carefully, and place the jar on the appropriate picture.

Optional Activities:

1. Children make their own nose collages.

    Materials:

    magazines
    paste
    scissors
    construction paper

2. Children make their own smell collages.

    Materials:
    see #1

3. Children bring smell jars from home (preferably made of plastic) to share with the class.

4. If the teacher had access to a hot plate, different foods could be cooked for smell experiences. For example: onions, spaghetti sauce, vegetables.

5. In addition to the two uses for smell jars in the lesson, the eight smell jars (plus those brought in by the children-see #3) could be the basis for a learning center. There, the honor system would be in effect for the children to place the jars on the proper picture and then to gently remove the lid (aluminum foil not attached by rubber band) and check their results.

PRIMARY LESSON

INVESTIGATING EYES

COMPETENCIES

A. Processes

1. Observing
2. Inferring
3. Communicating

B. Biological Science

4. Animals
5. Human Biology

E. Attitudes

1. Toward Classwork
3. Toward Personal Use of Science
4. Toward Oneself
5. Toward Science and Society

LESSONS

Lesson 1 - Activity II: Observing different eyes and noticing similarities and differences.

Lesson 2 - ITV Video Module on Investigating Eyes. Forty-five minute TV presentation. (See Attachment.)

Lesson 3 - Activity 2: By tossing and catching bean bags, the children discover the importance of having two eyes.

Lesson 4 - Activity 3: Working in pairs, children do various activities to demonstrate how the blinking response protects the eyes.

Lesson 5 - Activity 4: Working in pairs, children observe how the eyelids function.

Lesson 6 - Activity 5, Competency Measure: Children observe changes in pupil size resulting from varying amounts of light.

Lesson 7 - Activity 6, Competency Measure: Students compare doll eyes with human eyes.

EYES

PRIMARY

"Investigating Eyes," Science Unlimited Video Tape, P, 15 minutes: Major areas of emphasis in the lesson include a recognition of ways in which our eyes serve us, the parts of the eye, some of the characteristic movements and properties of the eye, and importance of protecting the eyes from harm.

"See Better, Health Eyes," Coronet, P, 10 minutes, 1973: Of all our senses, sight tells us the most about our surroundings. Using our eyes to discover, work, and play leads us to look at eye structure, function, and care. Illustrates the importance of protection from infection, strain, intense light, flying objects, and having periodic eye examinations.

"Our Wonderful Eyes and Their Care," Coronet, P, 11 minutes, black and white, 1962: Emphasizes the importance of eyesight. Presents Joel's experiences in having his eyes examined, in being fitted for glasses, and in learning the rules for proper eye care.

"Your Eyes," EBEC, P, I, 7 minutes, color, 1964: Basic Life Science Series: Demonstrates ways in which we depend upon our eyes. Shows by animation, the organic function of the eye. Instructs proper ways of taking good care of the eyes.

OTHER

"Eyes-Seeing the Light," Centrom, I, J, 15½ minutes, color, 1981: Animation and live action photogrphy illustrate the structure and function of the human eye. The viewer learns how eyelids, eyebrows, and tears provide protection for eyes and discovers how six muscles control eye movement.

INVESTIGATING EYES

Television Introduction

Teacher Orientation

This introduction is designed to provide a transition into the "science activities" which you will conduct following it. You will probably want to spread the Science Unlimited lesson activities over several days. Emphasis in this television presentation will be placed upon introducing basic concepts and techniques leading to student instructional objectives as well as techniques that you may use to promote these desired objectives.

Major areas of emphasis in the lesson include a recognition of ways in which our eyes serve us, the parts of the eye, some of the characteristic movements and properties of the eye, and the importance of protecting the eyes from harm.

During the televised lessons children are encouraged to perform some investigations with a partner. The partner teams can be organized prior to turning on the set.

In the following Science Unlimited lesson activities, the teacher will probably need to guide the children to work in a deliberate manner in order to really observe the eye responses (i.e. "one" surprise "clap" to get a true blink).

Avoid the use of "Why" questions during discussions. In this lesson children are merely beginning to discover the wonder of the reactions of their eye as it makes adjustments to help them to see under various changing conditions.

On seven occasions during this television introduction, questions are posed and time is provided for discussion in the classroom. The following charts indicate the questions raised and suggested techniques which may be followed:

SCIENCE UNLIMITED: INVESTIGATING EYES

Discussion Period and Time	TV Image	Final Broadcast Statement	Suggested Statement or Questions	Teaching Strategy
	Scenes in which children use their eyes.	Watch carefully and describe all of the ways you see that your eyes help you.	How else do our eyes help us?	Answer[2] Evidence
1 25 sec.	Diagram of the eye.	Suppose you take a moment and see how many parts you	What different parts of the eye do you observe?	Process[5] Communication
2 30 sec.	Moving finger in front of the eyes.	What are your eyes doing to help you see your finger?	Watch carefully.	Ideas[1] Materials Ideas
3 45 sec.	Child moving finger with head and eyes still.	After you've tried it on one side, try it on the other. Describe what happens.	Do what you see the child on TV doing.	Ideas[1] Materials Ideas
4 45 sec.	Finger moving in toward and out from the eyes.	Describe everything that happens.	Move your finger in and out and tell us what you notice? Try it several times before you answer.	

SCIENCE UNLIMITED: INVESTIGATING EYES

Discussion Period and Time	TV Image	Final Broadcast Statement	Suggested Statement or Questions	Teaching Strategy
5 45 sec.	Finger between eye and TV set.	Do you have any ideas about why it happens?	What does the TV set look like when you are looking at your finger.. and what does the finger look like when you are looking at the TV set?	Ideas Materials Ideas
6 25 sec.	Hands clapping before face.	Describe what the eyes do. Can you explain why?	Clap just once but wait a few seconds so your partner won't know just when you are going to do it.	Ideas[1] Materials Ideas
7 1 min.	Eye with pupil getting larger or smaller.	Why do you think it is happening?	Do you think the light has any effect on the eye?	Process[5] Inference

Title: Investigating Eyes

Level: Primary

Aims: From Science Unlimited Toward Which this Lesson Contributes

1. The student will explain basic conceptual schemes of the material world using personal experiences acquired through various activities as the basis for his explanation.

2. The student will demonstrate competency in the use of the process of science by: (a) observing, (b) communicating, (c) inferring.

Instructional Objectives: At the conclusion of this lesson, the students will be able to:

1. Describe changes in the appearance of their eyes in response to various occurrences in the environment:

    a. unexpected object flashing past eye.

    b. changes in direction of object to be looked at

    c. changes in lighting

BACKGROUND INFORMATION

In this lesson children are given specific directions concerning what to do. Experience with young children suggests that the teacher clearly demonstrate activities 3 and 4 to increase the chances of productive observation and to insure safety. Young children usually need to be reminded that they won't be able to make observations unless they do as instructed. The activities are not open-ended, although all student comments, when based on observation, should be openly accepted. We are interested in "what children can find out" by observing as they carry out activities as opposed to "what they can repeat back to us" when we tell them.

The dark spot in the center of the eye is called the pupil. It is an opening surrounded by the colored ring called the iris. The iris adjusts to change the size of the pupil opening in response to the amount of light reaching the eyes. The pupil is smaller in bright light than in dim light.

The lens of the eye is located just behind the opening in the iris. An intricate system of muscles control the lens, the iris and other parts of the eye.

If children wear corrective lenses, the teacher must decide on an individual basis whether this lesson is inappropriate due to progress in student adjustment to the correction. Often, the lesson can be expanded to include an interesting discussion of children's glasses and how they help them see better.

Total equipment list for a class of 30 pupils

15 balls or bean bags - alternative -- one or two
15 blindfolds - you might use discs of cardboard with ribbons
for tying on the head
large drawing of eye - optional
doll or toy animal with some moving part to the eyes

Activity I

Materials: for each two children - A ball or bean bag and a blindfold

If most children are able to catch a ball or bean bag, do this as a class activity with children working in pairs. If not, do this as a class demonstration, using several "good catchers" in turn.

Have the children stand an appropriate distance apart and toss a ball back and forth 20 times, keeping a record of successful catches versus unsuccessful catches. Then blindfold one child of each pair, covering one eye only, and again have pair tje toss 20 times, keeping a record. Have partners exchange the blindfold and repeat the activity.

Blindfold one eye of several children. Have them hold their arms straight out to the side, with forefinger only extended. Then show them how they are to move their hands in an arc toward each other to touch their forefingers in front of them at arm's length.

Repeat this activity without the blindfold.

Most children will probably fail to bring fingers their together with one eye blindfolded, but will have no problem doing so with both eyes open.

Discuss the idea that two eyes help us do many things more successfully than we can do them with only one eye.

Activity II

Materials: optional - large drawing of an eye

Arrange the children in groups of four. Explain that children are to work in pairs, looking at, but not touching, each others eyes.

Then have each child look at the eyes of the three other children in the group. Have them decide how many likenesses and differences they can discover. Discuss all observations.

Activity III

Equipment - none

Have the children work in pairs, taking turns with each other doing the activities listed below. Demonstrate each activity with one child first, cautioning the children not to get close enough to their partner to touch him or her. For safety, have the students shield their eyes with clear plastic (overhead transparency).

1. Move a hand slowly past your partner's face.
2. Move a hand rapidly past your partner's face.
3. Clap hands in front of your partner's face.
4. Throw a small wad of paper toward your partner's eyes.

(Note - Do the above activities as demonstrations, using several children in turn, if you feel your children will not demonstrate safe behavior.)

Have the children discuss their ideas about how blinking might help protect the eyes.

Then have the children close their eyes and feel the hard bones above and below their eyes. Discuss how these bones help protect the eyes.

Activity IV

Instruct partners to stare at each other trying not to blink. Tell children to raise their hands as soon as they see their partner blink.

Tell children to look at teach other and try to open their eyes as wide as they can. Then close their eyes as much as they can and still see each other. Ask them to describe how eyelids change when they close their eyes, discussing how each eyelid (upper and lower) is involved.

Have the children, in turn, watch their partner's finger as:

a. their partner moves his or her finger slowly to one side and then the other in front of them.

b. he moves his finger downward and upward.

Discuss Observations

Have one child of each pair sit in a chair with his partner behind him. Explain that the seated child must keep his head facing straight forward. Have partner hold his hand out to the side and slowly bring it around toward the front of the seated child. How far around must he bring his hand before the seated child can see it?

Activity V - Competency

Darken the classroom as much as possible. Have the children, in pairs, look at the pupil in one of their partner's eyes.

Then turn the lights on in the room. What changes in the pupil of the eye did the children notice? Repeat this change from dark to bright light several times so the children have adequate opportunity to observe the change in the size of the pupil.

Activity VI - Compentency

Obtain a doll or toy animal with some movable part or parts to the eyes. Solicit comments from children on how the toy eyes are like their eyes and how they are different.

PRIMARY LESSON

INVESTIGATING COLOR

COMPETENCIES

A. Processes

  1. Observing
  2. Classifying
  6. Communicating

C. Physical Sciences

  2. D. Light/Color

LESSONS

Lesson 1 - Activity 1, Investigating Color: Children identify the 3 primary colors and discuss the feelings that those colors elicit.

Lesson 2 - Video module on Investigating Color. Forty-five minute presentation. See attachment.

Lesson 3 - Activity II, Investigating Color: Children classify objects of color. This activity may be followed up by classifying objects of like color into groups of like objects.

Lesson 4 - Activity III, Investigating Color: After seeing a colored object, children identify other objects they see that match the color. The children are also encouraged to give reasons for objects being a particular color.

Lesson 5 - Activity IV, Investigating Color: Children experience mixing and observing new colors with paints and crayons. The term Secondary Color is introduced.

Lesson 6 - Activity V, Investigating Color: A competency activity which asks children to identify primary colored-objects and colors which make up secondary colors.

COLOR

PRIMARY

"Color: A First Film," BFA, P, 13 minutes, color, 1979: An illustration of the importance of color in our lives followed by experiments that allow students to analyze white light and to see what happens when the primary colors are combined as light from colored light sources and as pigments. (Repeat from Light, Primary).

"Color, Color, Everywhere, Red, Yellow, Blue," Cort, K, P, 11 minutes, color, 1972: Uses a delightful blend of brillant photography and rhymed narration to introduce the exciting world of color. Explores the 3 primary colors.

"Color! Color! Color!" AIMS, P, 15 minutes, color, 1973: Uses items in nature such as flowers, vegetables, stones and animals to illustrate the many colors of our world.

OTHER

"Color for Beginners," Cort, P, I, 8 minutes, color, 1967: Summarizes some of the characteristics of color, explaining why objects have different colors depending upon situation and consult. Names the spectrum of colors and discusses the basic reflectance of colors using everyday materials.

Title: Investigating Color (Patty Gehret)

Level: Primary

Aims: Toward Which This Lesson Contributes

1. The student will solve problems by gathering information, working independently, using equipment and materials, observing purposefully and drawing conclusions based on these findings.
2. The student will demonstrate competency in the use of the process of science by: (a) observing, (b) classifying, (c) communicating.
3. The student will defend a point of view by making use of supportive evidence.

Instructional Objectives: At the conclusion of this lesson, the students will:

1. Identify the primary colors.
2. Name objects of given colors within a given area.
3. Sort objects of various colors.
4. Create different secondary colors by mixing primary colors.
5. Express feelings about primary colors.

BACKGROUND INFORMATION

This lesson is intended as an introduction to color. The children will begin with an observation of the primary colors and their names. They will be introduced to the terms primary colors and secondary colors. They will next sort objects according to color through the use of concrete materials. Children will then draw from past experience and surroundings and identify objects containing the primary colors. The children will experiment briefly with primary colors to form secondary colors. Objects listed should be viewed as helpful suggestions. Alternative items could be substituted according to what is most easily available.

Total Equipment List for a Class of 30 Pupils:

One piece of red, yellow and blue construction paper
Magic marker
One jar of red, yellow and blue tempera paint
Paper plates
Wooden sticks

Suggested list of objects for Activity #2:

3 red, 3 blue, 3 yellow candles
3 red, 3 blue, 3 yellow pencils
3 red crayons, 3 blue crayons, 3 yellow crayons

3 pieces of red, blue, yellow yarn
3 red, 3 blue, 3 yellow balloons
3 pieces of red, blue, yellow material
3 pieces of red, blue, yellow paper

Activity I - Readiness

Materials: One piece of red, blue, yellow construction paper, magic marker

Arrange the class in a semi-circle around the teacher with each sheet of paper displayed. Discuss each sheet of paper as to color, and the feelings that color elicits. Write the name of the color at the top of each sheet of paper. Discussion could also be centered on how each color makes one feel, or what the world would be like if everything was red, blue, or yellow. The term Primary Color should be introduced in this lesson.

Activity II

Materials Needed:

3 red, blue, yellow candles
3 red, 3 blue, 3 yellow pencils
3 red, blue, yellow crayons
3 pieces of red, blue, yellow paper
3 red, blue, yellow balloons
3 pieces of red, blue, yellow material
3 pieces of red, blue, yellow paper

Divide the children into three groups. Give each group a set of the objects. Have the pupils arrange the objects into groups according to color. Further classification skill could be developed by having student classify the different color objects into groups of like objects (crayons, balloons, etc.).

Activity III

Materials: One piece of red, blue, and yellow construction paper, magic marker

Have the children seated in a semi-circle large group. Take each color separately; have the pupils name objects of that color that they can see. Encourage the pupils to give reasons for the objects being certain colors.

Activity IV

Materials: One jar of red, yellow, blue tempera paint, paper plates, wooden sticks, red, yellow, blue crayons

Divide the children into three groups. The children may then work as a group or separately. Each child should be given a paper plate to mix colors on and some of each of the primary colors. The children should then experiment mixing colors together and noting new colors they have created. Discuss colors that should be mixed together to create each secondary color. The term secondary color should be introduced during this lesson. The children may experiment further using crayons to see if they come up with the same results.

Suggested Operational Questions:

1. When you mix certain colors together, what color do you create?
2. What do you think will happen when you add more yellow to the blue?
3. Can you think of any color that we weren't able to produce?

Activity V - Competency

Materials: Materials used in Activity #2

Pupils may be tested as a group or individually.

1. Hold up a red object.
2. Hold up a blue object.
3. Hold up a yellow object.
4. Hold up the two colors that make green.
5. Hold up the two colors that make orange.
6. Hold up the two colors that make purple.
7. Name something in the classroom that is red.
8. Name something in the classroom that is blue.
9. Name something in the classroom that is yellow.

PRIMARY LESSON

INVESTIGATING AIR

COMPETENCIES

A. Processes

1. Observing
2. Classifying
3. Inferring
4. Predicting
5. Measuring
6. Communicating
9. Formulating Hypotheses
10. Experimenting
12. Interpreting Data

C. Physical Scinece

1. A. Form/State of Matter
2. G. Force and Machines

D. Earth and Space Science

5. Weather and Climate

E. Attitudes

1. Toward Classwork
3. Toward Personal Use of Science
4. Toward Oneself

LESSONS

Lesson 1 - Activity I, Readiness Activity, Investigating Air: Students observe natural responses to the wind, and work with pinwheels to observe wind characteristics.

Lesson 2 - ITV Video Module on Investigating Air. A forty-five minute ITV presentation. See attachment.

Lesson 3 - Activity II & III, Air is Real, Investigating Air: Students observe characteristics of soil and rock samples added to water, recording bubble observations.

Lesson 4 - Activity IV, Air in Soil, Water, and Rocks, Investigating Air: Students observe characteristics of soil and rock samples added to water, recording bubble observations.

Lesson 5 - Activity V, Competency, Investigating Air: Students construct and manipulate "parachutes," to study various wind sources as they effect parachute fall.

AIR

PRIMARY

"Air," AEBC, Natural Science 1st Films, P, 10 minutes, color, 1983: Our earth is covered by an ocean of air. Although it is all around us, air cannot be seen. We use it in many ways, and moving air brings changes in the weather. Without air, life on earth could not exist.

"Air and What it Does," EBEC, P, 11 minutes, color, 1962: Uses the problem solving approach to present basic concepts about the nature and properties of air, to show that it has weight, occupies space, and exerts pressure. Demonstrates among other things, a ball being inflated and weighed, and a glass being inverted in water. Reviews points made and poses questions requiring further experimentation.

"Air: A First Film," BFA, P, I, 10 minutes, color, 1968: Natural photography and a simple narrative introduce basic facts about air; an invisible ocean of air surrounds the earth; air is necessary for life; moving air is called wind, air has temperature and can hold moisture, many machines need air to function; sound travels through air, dust particles are in air, rockets go above the earth's air, and air makes the daytime sky blue.

"Wind," AEBC, P, 10 minutes, color, 1983: We cannot see the wind, but we can see what it does. As it moves over the city and countryside, it lifts our kites, sways the trees, and dries the washing on the lines. It makes waves on the water, loosens the seeds from plants, and carries them away, and blows smog and smoke away from the city. The wind is part of the weather. Rain clouds come and go with the wind.

OTHER

"Air All Around," (IU), P, 10 minutes, color, 1962: Points out that air lacks color, taste, and odor; and shows uses of compressed air. Then examines the role of air in burning and the part heated air plays in pushing jet planes along and creating winds. Closes with a summary of some of the important uses of air.

"Air All Around Us," MCGH, P, I, 11 minutes, color, 1962: Demonstrates the classic experiments with air to show that it has weight, occupies space, and exerts pressure. Demonstrates among other things, a ball being inflated and weighed and a glass being inverted in water. Reviews points made and poses questions requiring further experimentation.

Title: Investigating Air (Nancy Boling)

Level: Primary

Aims: From Toward Which This Lesson Contributes:

1. The student will solve problems by gathering information, working independently, using equipment and materials, observing purposefully, and drawing appropriate conclusions based on his/her findings.

2. The student will demonstrate competency in the use of the processes of science by: (a) observing, (b) classifying, (c) communication, (d) inferring, (e) predicting.

3. The student will defend a point of view by making use of supporting evidence.

Instructional Objectives: At the conclusion of this lesson, students will be able to:

1. Observe and describe the effects of moving air.

2. Use observations to support inferences that air is a real substance and takes up space.

3. Use observations to support inference that moving air has force and can move things.

4. Use observations to support the inference that air is all around us.

5. Identify and relate examples of moving air that they experience in their everyday lives.

BACKGROUND INFORMATION:

Most young children have had many experiences with air, but most of the time are completely unaware of air, since it is invisible and has no color, taste, or odor. They know that they must "blow up" their balloons and pump something into their bicycle tires, but it is doubtful they have ever thought of air as a real substance.

Air is introduced in this lesson as a substance which is all around us. The theme throughout is the concept that air is invisible yet noticeable by its effects. The children observe the effects by observing the effects of moving air. This will provide a background enabling them to recognize such properties as mass and weight, and to appreciate that air can be used.

List of Equipment for a Class of 30 Pupils:

- 30 pinwheels
- 30 balloons
- 30 soap bubble rings
- 8 jars of bubble solution
- 8 large clear jars
- 30 clear plastic glasses
- 8 large rubber erasers
- 1 bicycle pump
- 1 balloon pump
- 1 fan (hand type)
- 1 ball of string

*Prior to teaching lesson, have children bring in:

- bag of dry soil
- assorted sizes of porous rocks
- thin plastic cut into 12" x 12" squares (possibly baggies) or they may use squares of very thin cloth

Activity I - Readiness - (Instructional Objective 1)

Materials: Pinwheels
Story Chart Paper

Take the children outside to observe the effects of wind. (If not possible, they may observe from a classroom window.) Observe such things as: leaves on trees, smoke, blades of grass, flag on flagpole. Distribute pinwheels--children will observe effects when holding pinwheel various ways in the wind.

Questions you might use are:

1. In what ways can we see that air is all around.

2. What could we do to make the pinwheel go faster?

Use wait-time methods to allow children to observe and relate their observations. Through the use of operational questions, elicit the idea that we can see the effects of moving wind without seeing the air. Upon returning to the classroom, write an experience chart of the observations. Encourage children to discuss their own experiences with moving air.

Activity II - Air is Real - (Instructional Objective 2)

Materials: 30 balloons
16 pinwheels

(Children will work in groups of 4-5)

Distribute a balloon to each child. Observe and describe size, shape, texture of deflated balloon. Record observations. Instruct children to blow into their balloons; twist ends of balloon and hold tightly. Observe and describe size, shape, texture of inflated balloon. Record observations.

Release neck of balloon, allowing air to blow against hand as you free air. (demonstrate to children) What do you feel? What do you see? Some children may hold a pinwheel while others release air from their balloon.

Operational Questions you might use are:

1. In what ways is the inflated balloon different from a balloon without air?

2. Could we make this air move something?

Activity III - Air is Real - (Instructional Objective 2)
(May do this on same day as Activity II).

Materials: 30 bubble rings
8 jars of bubble solution

(Children will work in groups of 4-5)

Distribute one jar of solution to each group and one bubble ring to each child. Have children blow bubbles. Try blowing through ring in various ways (easily, hard, far away, close). Encourage children to describe bubbles. Record observations.

Activity IV - Air in Soil, Water, and Rocks (Instructional Objective 4)

Materials: 8 large jars (half-filled with water)
8 small containers of dry soil
16 clear plastic glasses (half-filled with water)--
2 to each group
several porous rocks to each group

(Children will work in groups of 4--5)

Children in each group will observe and describe both glasses of plain water. Record observations.

Put soil in one glass. Observe and describe. Record observations. Are there bubbles coming up from the soil?

Place both glasses aside for awhile to observe later.

Have the children observe a large jar of water and describe it. Observe various rocks and describe them. (shape, size, texture) Place porous rocks in a jar of water (just one at a time) and record observations of changes in the water.

Questions you might use are:

1. What could cause bubbles?

2. Where does the air come from?

3. Did each rock produce the same effect in water?

Activity V Competency - (Instructional Objectives 3 and 5)

Materials: 1-12" x 12" square of plastic or cloth for each group
4 equal pieces of string for each group
1 large rubber eraser for each group
1 bicycle pump
1 balloon pump
1 fan
several sheets of folded newspaper

Instruct children to work together to tie one piece of string in each hole, thus giving a parachute effect. When this is completed, have children take turns dropping the rubber eraser to floor from various heights. Also drop parachutes from various heights (stand on desk or chair). Observe and record.

Working as a group--children will fasten eraser to the four parachute strings. (tie all four corners securely to eraser)

How will the parachute move now? Ask for predictions and record. Children will then drop a parachute with erasers attached.

Questions you might use are:

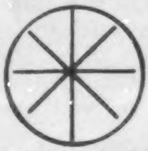
1. Can you tell us what you observed?

2. Could we make the parachute fall slower?

Distribute one air producing device to each group. (bicycle pump, balloon pump, fan, and folded newspaper) Have another group use their mouths to produce air. Have one child in each group "blow" air on parachute as one child drops parachute from desk, allowing each group to try each air device. Chart observations.

Enrichment Activities:

1. Make a "Wind Spinner"
Cut a paper plate from the middle. Fold points back and forth.



Wait until the wind is blowing outside. Set wind spinner on playground, but be sure to keep your eye on it. It may get away from you!

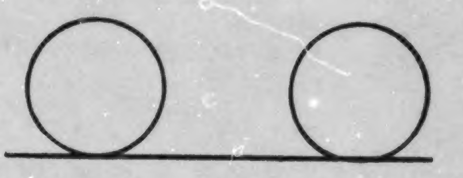
2. Make "Strange Airplanes"
Children may design and construct various strange airplanes. This activity may be set up at a learning center.

Materials Needed:
paper plates
straws
paper clips
scissors
scotch tape
strips of paper 1" wide (various lengths)

Post simple directions for children to follow.

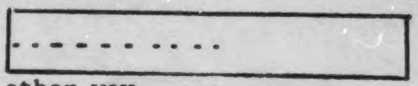
Ex. #1

Cut strips of heavy paper
Tape them into loops
Tape the loops to a straw
It will look like this!

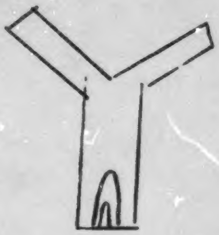


Ex. #2

Cut a long strip of paper halfway down the middle



Fold 2 flaps down
One going one way, one going the other way
Put a paper clip at the bottom
It will look like this!



Ex. #3

Design your own airplane!

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PRIMARY LESSON

INVESTIGATING WEATHER

COMPETENCIES

A. Processes

1. Observing
3. Inferring
4. Predicting
6. Communicating
13. Formulating Models

C. Physical Science

1. A. Matter: Form/State
1. B. Matter: Water

D. Earth and Space Science

5. Weather and Climate

E. Attitudes

1. Toward Classwork
2. Toward Interests and Careers
3. Toward Personal Use of Science
4. Toward Oneself
5. Toward Science and Society

LESSONS

Lesson 1 - ITV Video Module on Investigating Weather. Forty-five minute presentation. See attachment.

Lesson 2 - Activity I - Evaporation, "Investigating the Formation of Clouds and Rain," by Alan Corson, Geri Davis, and Roy W. Allison. Primary children investigate the "wetness" of several objects from one day to another and infer explanations for the disappearance of the "wetness."

Lesson 3 - Activity II - Making a Cloud or Fog, "Investigating the Formation of Clouds and Rain, by Alan Corson, Geri Davis, and Roy W. Allison. A fog or cloud is made and observed by children in the classroom.

Lesson 4 - Activity III - Hot Air Rises, "Investigating the Formation of Clouds and Rain," by Alan Corson, Geri Davis, and Roy W. Allison. Pupils observe that hot air rises by placing cotton threads or hair above a heat source.

Lesson 5 - Activity IV - Making Precipitation, "Investigating the Formation of Clouds and Rain," by Alan Corson, Geri Davis, and Roy W. Allison. In this activity, the teacher demonstrates a water cycle illustrating evaporation, condensation, and precipitation.

WEATHER

PRIMARY

"Climates and Seasons," Cort, P, 10 minutes, color, 1973: A variety of seasonal activities introduces youngsters to basic ideas about climate and seasonal changes. Explores variations in the four seasons due to climate in all areas of the U.S.

"Rain: A First Film," BFA, P, I, 10 minutes, color, 1973: Cloud pictures are fund to find. Clouds also tell us when it is going to rain. What clouds are is described and explained, and the beauty of rain and the rainbow is pointed out.

"The Weatherman, A Community Helper," BFA, P, I, 11 minutes, color, 1970: Shows how scientists called meterologists, use special instruments and knowledge to measure and record weather data from all parts of the world. With this information, they predict the weather so that farmers will know about growing conditions, the ship captain will know the wisest course for his ship and people in all walks of life will know how to make their daily plans.

"Clouds," AEBC, Natural Science First Films, P, 10 minutes, color, 1983: This program introduces the primary grade pupil to a variety of observations he himself can make about clouds. Clouds have many different appearance. Their shapes change: they may grow or they may fade away. Because they bring the water that supports all life on land, clouds are important to man.

Other

"Clouds," BFA, P, 10 minutes, color, 1966: Introduces the various basic shapes and sizes of clouds and describes their composition. Explains the moisture content and the effects of evaporation. Specifies the usefulness of clouds to life on earth because of their water carrying capacities.

Title: Investigating the Formation Clouds and Rain (Alan Corson, Geri Davis, and Roy W. Allison)

Level: Primary

Aims: From Toward Which This Lesson Contributes

1. The student will formulate and ask questions of the environment. The student will use questions to describe, clarify, analyze problems and to provide direction for problem solving.

2. The student will solve problems by gathering information, working independently, using equipment and materials, observing purposefully and drawing appropriate conclusions based on these findings.

3. The student will explain basic conceptual schemes of the material world using personal experiences acquired through various activities as the basis for his explanation.

4. The student will demonstrate competency in the use of the processes of science by: (a) observing, (b) classifying, (c) communicating.

Instructional Objectives: At the conclusion of this lesson the student will be able to:

1. Describe evaporation in simple terms.

2. Describe condensation in simple terms.

3. Demonstrate how clouds and fog are made.

4. Explain what causes rain.

5. Describe precipitation in simple terms.

6. Explain how a simple experiment can be set up in the classroom to show the process of making rain.

BACKGROUND INFORMATION

Water exists in all three states of matter. 1. When it is a liquid, we call it water. 2. When it is a gas, we call it water vapor. 3. When it is a solid, we call it ice. Our first activity will be to determine how water gets into the air.

Warm air can hold more water in the vapor stage than can cold air. As air is cooled it loses its ability to hold as much water vapor, causing some of this water vapor to condense to form clouds, fog, dew, frost, rain or snow. The conditions and location where this cooling takes place will determine which of these six will be formed.

If warm air laden with water vapor rises into the atmosphere, it usually cools causing some of the water vapor to condense into tiny droplets of water. A large collection of these tiny droplets form what we call a cloud. If the cooling continues, the droplets will grow larger and heavier until precipitation (rain) occurs. When the temperature is below freezing when this condensation takes place, snow instead of rain is the result.

Total Equipment List

cooking pan
wooden ruler
6 metal pie pans
6 large mouth 1 gallon glass jars
1 spool mercerized cotton thread
cold water
paper towels
hot plate
6 flashlights
bucket
large glass jar
broom handle
food coloring
string
ice
stand
salt
spoons
funnel
cans
timer
towel
sponge
rags

Activity I - Evaporation

Materials needed - sponge
pan
water
rags
paper towels
string

Have the students put up the string as a wash line to hand out our "wash." Then have them wet each of the rags and hand them on our wash line.

Next have a student "wash" the chalkboard using the sponge, pan, and water.

Place the pan of water at or near the heater for observation both now and later.

After all these things have been completed, ask the students "Will these items remain wet until class time tomorrow?" "What will happen to the water if everything is dry tomorrow?" "Where will the water go?" "Can we get the water back?"

Activity II - Making a Cloud or Fog

Materials needed - 6 large mouth 1 gallon glass jars
6 metal pie pans
salt
ice
hot water
6 flashlights

Place some warm water into the gallon glass jar to warm the glass. Pour out the warm water and replace it with hot water. Place the jar on a table for observation.

Put a mixture of ice, cold water, and salt into the pie pan and place the pie pan over the opening of the gallon glass jar. Observe what forms in the gallon jar at or near the top of the jar. If you shine the flashlight through the sides of the jar near the top it may help you observe.

The haze you observe would be called a cloud if it were formed in the sky above the earth. If the same haze were to form near the ground, it would be called fog.

The shape of a cloud and the altitude of the cloud helps to determine the names we give them.

Activity III - Hot Air Rises

Materials needed - hot plate
wooden ruler
tape, thread or hair

Take a three inch length of mercerized cotton thread apart. There should be three or four very fine strands making up the thread. Tape these strands to the wooden ruler. Very fine (blond) human hair could also be used instead of the strands of thread.

Hold the ruler over a heat source and watch the thread strands or blond hairs be blown upward by the rising hot air.

Activity IV - Making Precipitation

Materials needed - hot plate
pan to boil water
bucket
broom handle
ice
water and salt

This is a teacher demonstration.

This activity is a speeded up water cycle. All the elemets are here in that 1. water becomes water vapor, 2. water vapor condenses to form droplets of water, 3. these droplets enlarge by both further condensation and combining two smaller drops to form a larger drop, and 4. the large drops become heavy and fall. This then represents evaporation, condensation, and precipitation.

Place a pan of water on the hot plate to be heated. While this water is heating, the teacher could discuss with the class the concepts of 1. Evaporation form Activity I, 2. Condensation from Activity III, and 3. Hot air rises from Activity III.

Place two student chairs on opposite sides of the hot plate and put a broom handle between the two chairs. Hang the bucket from the broom handle so that it hangs above the water being heated. Place some ice, cold water, and salt in the bucket to keep it cool. Have the students observe the outside of the bucket.

As tiny drops of condensation begin to appear the teacher could ask "What do you see?" "Where did these tiny drops come from?"

The teacher could run a finger through some of the condensation on the side of the bucket to draw the students' attention to the change that has taken place.

As the drops grow larger by additional condensation or by small drops combining the teacher could ask, "Are the drops getting larger?" "Which drop will fall first?"

PRIMARY LESSON

INVESTIGATING OBSERVATION AND DESCRIPTION

COMPETENCIES

A. Processes

1. Observing
2. Classifying
5. Measuring
6. Communicationg
12. Interpreting Data

B. Biological Science

1. Characteristics of Living Things

E. Attitudes

1. Toward Classwork

LESSONS

Lesson 1 - Activity I, Investigating Observations and Descriptions: Children choose an object and describe it to the rest of the class. Descriptions should include as many of the senses as possible, giving the other children enough information to guess what the object is.

Lesson 2 - ITV Video Module on Investigating Observation and Description. Forty-five minute ITV presentation. See Attachment.

Lesson 3 - Activity II, Investigating Observations and Descriptions: Using objects from the first lesson, children develop categories for these objects based on their similarities and differences. The children then place their objects into one of the categories.

Lesson 4 - Activity 1, Investigating Classification Methods (Roy Allison): Children use their skills of observation to determine which container is holding a marble.

Lesson 5 - Activity II, Investigating Classification Methods (Roy Allison): Children use their observation skills to determine which of the containers has vinegar in it. A good lesson to reinforce safety of tasting and smelling unknown substances.

Lesson 6 - Activity III, "Handprints:" Children make handprints then discuss their observations as to the similarities and differences of the prints made by other classmates.

OBSERVATION AND DESCRIPTION

PRIMARY

"Investigating Observation & Description," Science Unlimited Video tape, P, 15 minutes: The science concepts for which this lesson serves as a readiness experience are: shape, weight, the senses, characteristics, and safety.

"Observing," AIT, Out and About Series, P, 15 minutes, color: In the grocery store and in the library, Molly and her friends learn to use all of their senses to observe the characteristics of an object.

"Observing Size, Shape, and Color," AIT, Hands On Series, P, 15 minutes, color, 1975.

OTHER

"Learning to Use Your Senses," EBEC, P, 11 minutes, color, 1971: Encourages children to verbalize sensory perceptions. Points out that people use their five senses automatically and explains how to learn about the environment by using the senses.

"Me and My Senses," BFA, P, I, 10 minutes, color, 1970: Two boys explore how their senses work for and against them. Illustrates the use of sight, taste, smell, hearing, touch, and common sense.

INVESTIGATING OBSERVATION AND DESCRIPTION

Television Introduction

Teacher Orientation

This introduction is designed to provide a transition into the science activities which you will conduct following it. You will probably want to spread the Science Unlimited lesson activities over several days. Emphasis in this television presentation will be placed on introducing basic concepts and techniques leading to student instructional objectives as well as techniques that you may use to promote these desired objectives.

This program was televised in the classroom where children interact with the teacher and the environment as they play the child's game "I Spy With My Little Eye." Much of the televised program is centered around objects shaped like a doughnut. The program requires no science equipment. Attention is directed to the use of the senses in determining the characteristics of an object and the development of vocabulary for describing these as a useful tool for expression. Emphasis is also directed to the fact that a few descriptive words about one object may well accurately describe a large number of objects. Therefore, with only a few descriptive clues, a large number of speculations relative to what object is described may be accurate. Still another major area of importance is the warning that one must be careful in using his senses to observe his surroundings. Poisons, bright lights, loud noises, and noxious fumes can all be damaging to the body. The classroom teacher is urged to constantly alert children to the dangers of touching, tasting, and smelling unknown materials.

The science concepts for which this science unlimited lesson serves as a readiness experience are: shape, weight, the senses, characteristics, and safety. On six occasions during this television introduction, questions are posed and time provided for discussion in the classroom. The charts on the next page indicate the length of the discussion period questions raised and suggested strategies which may be followed.

SCIENCE UNLIMITED: INVESTIGATING OBSERVATION AND DESCRIPTION

Discussion Period and Time	TV Image	Final Broadcast Statement	Suggested Statement or Questions	Teaching Strategy
1 30 sec.	Hand holding doughnut	Can you name another object in your classroom that's about the same size as this doughnut?	Let's take a few seconds and look around the room. Can you think of anything you know that might be about the same size as the doughnuts?.. It is bigger or smaller than you hand? A plate? etc.	[4]
2 30 sec.	Hand holding doughnut	What could you tell someone to help him know how heavy it is?	What do you see around you that would be heavier than the doughnug? Lighter than doughnut?	Process[5] Inference
3 30 sec.	Hand feeling doughnut	For example, what do you know about how a doughnut would feel if you touched it?	Think of the doughnuts you have had. What words would you use to tell us how a doughnut feels?	Approval[3]
4 30 sec.	Child smelling, tasting	What words would you use to describe its tasts and its odor?	Have you eaten doughnuts recently? How would you describe the smell or taste of the doughnut (on TV)?	Approval[3]
5 30 sec.	Doughnut on plate	OK, can you think of any other characteristics that you would use to describe a doughnut?	How else would you describe a doughnut? Can you think of any characteristic we might have missed? Can you bend doughnut?	Open[6] Ended

SCIENCE UNLIMITED: INVESTIGATING OBSERVATION AND DESCRIPTION

Discussion Period and Time	TV Image	Final Broadcast Statement	Suggested Statement or Questions	Teaching Strategy
6 1 min. 30 sec.	Two flowers in a vase	Suppose you take a few minutes and list everything you can about it.	How many things could you see that would help us describe the flower?	Process[5] Observation & Communication

Title: Investigating Observation and Description

Level: Primary

Aims: Toward Which This Lesson Contributes

1. The student will demonstrate competency in the use of the processes of science by: (a) observing, (b) classifying, (c) communicating, (d) measuring, (e) recording, (f) interpreting data.

2. The student will defend his point of view by making use of supporting evidence.

Instructional Objectives: At the conclusion of this lesson, the students will be able to:

1. Make descriptive statements about the physical characteristics of an object which they select.

2. Use a wide range of descriptive statements based on an expanded awareness of the role of their senses in observation.

3. Classify the descriptive statements used by themselves and others according to the sense which was used as a base for the descriptive statement.

BACKGROUND INFORMATION

The basic assumption underlying this series of lessons is that primary (and intermediate) grade students vary greatly in their ability to observe, describe and communicate their perceptions of objects or persons in their environment. These lessons begin simply, using objects from the child's own personal environment, and extend to less familiar objects in his expanded environement. In a similar manner, the students earliest descriptive statements are accepted as the base level of verbal operation and from that point he is encouraged to use a greater number of his senses to sharpen the descriptive statements which he formulates. In addition, these lessons are able to help each student begin to approach the tasks of observation, description and communication in a more systematic way. This entire description is conducted at the verbal level. Records are completed by the teacher with assistance from the students.

The basic technical information is directly related to the five senses. These lessons should encourage students to utilize to a fuller extent all of the senses they have available.

This series of lessons is designed to be used over an extended period of time. The time will vary according to the interest of the class. The suggested activities can be initiated as a group but may be extended into individual student activity or into student science activity centers.

There are no special materials required. This is not a seasonal exercise. It is appropriate at any time and is the type of lesson that benefits from repetition.

Total Equipment List

1. Objects students select from their own personal environment.

2. Someplace for the student to hide his "secret" object. (i.e. in his pocket, in an envelope, in his desk)

3. Chalkboard and chalk, or newsprint and felt pen or crayon.

Activity I - Readiness Survey

Materials needed: pupils

Ask each child to quietly and secretly select an object from his desk or from his own personal possessions. Ask that the children think about the item they have chosen and decide just how they will describe the characteristics of this object to the others in the class without naming the object or describing how it is used.

Arrange the students in a circle and begin the process of description. The purpose here is to have the students describe the characteristics related to size, weight, shape, color, construction, smell, feel or taste adequately in the class so that the children can identify the object.

After several children have described their object and have permitted the total group to observe the objects, direct the children's attention to the kinds of descriptive statements that students have been making. Select those statements which are most useful in identifying the object.

Discuss which senses the children have used to describe the object. List on the board or on newsprint those senses which the children identify. If all five senses are not identified, encourage further disucssion to complete the list.

see hear smell feel taste (or similiar words which identify the five senses)

Tally the senses which each child had used in his descriptive statements.

This may do two things: first, it may encourage a wider range of sensory based statements, and secondly, it will provide a tally to show just which of the senses the class uses most frequently in describing an object...and thereby indicates which senses we will want to explore to sharpen our powers of both observation and description.

This is also a form of classification, a fact that the class may be encouraged to discover. -- (Let the students dig it out for themselves -- then let them verbalize it for others in the class.)

This initial activity will provide an opportunity to have each member of the class respond. Make mental notes about the level of each child's response or jot down some coded information about each child's response to indicate the level at which he started this series of lessons.

Activity II

Materials needed: The pupils and the objects they selected in Activity I.

Using the same group of varied objects, ask the children to group the objects which have similar characteristics. This discussion may lead into the types of classification that they may want to try...it would be possible to group objects by their function (use), their construction, their weight, or their color. The selection or development of the categories should be established by the class.

Once the categories are established, each student may then place his object in a category. He must, however, have a reason for placing his object in a category. Other students in the group may raise questions or challenge the placement of any object as long as they have a valid reason. This may lead to a finer description of the basic categories.

In this lesson, as in the previous one, there will be a variety of responses. Be aware of this fact and seek to permit each child their response. Encourage him/her at his/her level of operation. Learning experiences conducted in this way permit correct student responses which may not have been anticipated.

Competencies

The competencies stated in the instructional objectives can be checked and verified throughout the progress of the lesson. The skills developed in these activities are also important in reading, art, math, social studies and other areas of the curriculum. Therefore, it is assumed that you will encourage the use of these skills wherever they apply.

Title: Investigating Tracks (Carol Myers)

Level: Primary

Aims: From SFTS Toward Which This Lesson Contributes:

1. The student will solve problems by gathering information, working independently, using equipment and materials, observing purposefully, and drawing appropriate conclusions based on his/her findings.
2. The student will demonstrate competency in the use of the processes of science by (a) observing, (b) classifying, (c) communicating, (d) inferring, (e) predicting.
3. The student will defend a point of view by making use of supporting evidence.

Instructional Objectives: At the conclusion of this lesson, students will be able to:

1. Observe and describe tracks made by objects.
2. Observe and describe tracks (prints) made using their hands.
3. Identify objects by examining their tracks.
4. Use observations to support inferences about tracks.

BACKGROUND INFORMATION:

Everyday children come in contact with prints and tracks. They leave nose prints on the windows, doors and walls, hand prints on appliances. They make tracks in the snow and tracks in their sand boxes or dirt piles. This is a good place to start a child's understanding of prints in his environment.

This lesson begins with tracks made by familiar objects, common to a child's environment, including their own hand prints. During activities in this lesson children are encouraged to investigate and freely state observations and inferences in their own ways.

This lesson is a stepping stone to Investigating Tracks on the Intermediate Level, where children investigate the human foot print and animal tracks.

List of Equipment for a Class of 30 Pupils:

6 Aluminum 8" pie pans
6 Sponges cut to fit in pie pans
1 Jar of dark tempera paint
30 Pieces of 12" x 24" white construction paper
30 Pieces of 9" x 11" white construction paper

Set of objects (suggested list of track markers)
- 6 Toy cars
- 6 Wooden rectangular and triangular blocks
- 6 Checkers (wooden)
- 6 5 cm. square sponges
- 6 Tongue depressors or popsickle sticks
- 1 Roll of self paper
- Paint shirts
- Newspapers

Activity I - Readiness - (Instructional Objective 1)

Prior to the lesson prepare a set of tracks on a large sheet of shelf paper. Use the objects listed above or other objects with similar characteristics to make the tracks.

Assemble the children as a group. Tell the children that you have a sheet of paper with mystery tracks on it, and that you would like them to help you discover what made each track. Show them the paper. Ask for observations about the size and shape of the tracks. Ask: "Are there things around this classroom that could have made the tracks on this paper?" As the children name objects, discuss each item and what type of track they predict each will make.

Activity II - Investigating Tracks - (Instructional Objectives 1 and 3)

Materials Needed for Each Group of Five Children:

- 1 Aluminum pan with sponge soaked with tempera paint
- 1 Set of the objects listed in the equipment list
- Paint shirts for the students
- Newspapers to cover work area
- 1 Sheet of 12" x 24" white construction paper

Divide the children into groups of four or five. Demonstrate the procedure of making tracks. Let the children experiment making tracks by using each of the above objects. Encourage them to make as many different types of tracks as possible with each object.

Operational Questions you might use are:

1. How can you find out which object made each track?

2. What are some things you have to do to your objects to make the tracks?

3. Are there other ways you can use your objects to make tracks?

Activity III - Hand Prints (Instructional Objective 2)

Materials Needed for Each Group of Five Children:

- 1 Aluminum pan with sponge saturated with tempera paint
- Paint shirts

Newspapers to cover tables
30 Sheets of 8" x 11" white construction paper

Have each child place their hand on the saturated sponge and transfer their hand to a piece of white construction paper to make a print. Discuss their observations as to likenesses and differences of their hand prints to those of other children in their group. Ask: "In what ways are their hands alike or different from their hand prints?" Students should notice differences in size and shape; also missing parts of hand prints, due to hand pressure.

PRIMARY LESSON

INVESTIGATING MYSTERY BOXES

COMPETENCIES

A. Processes

1. Observing
2. Classifying
3. Inferring
4. Predicting
5. Communicating
9. Formulating Hypotheses
12. Interpreting Data
13. Formulating Models

C. Physical Science

1.A. Form/State of Matter

E. Attitudes

1. Toward Classwork
3. Toward Personal Use of Science
4. Toward Oneself
5. Toward Science and Society

LESSONS

Lesson 1 - Activity 1, Students work as a group to describe as many characteristics as possible of different objects, then use these characteristics to differentiate between objects grouped in paris.

Lesson 2 - ITV Video Module on Investigating Mystery Boxes. Forty-five minute ITV presentation. See attachment.

Lesson 3 - Activity II, Students work with two mystery boxes of known contents to practice their indirect observing and measuring skills.

Lesson 4 - Activity III, Students observe sealed mystery boxes of unknown contents with all their senses to attempt to identify the contents.

Lesson 5 - Activity IV, Competency Measure, Students manipulate two mystery boxes to identify the contents from a group of objects on display.

MYSTERY BOXES

PRIMARY

"Investigating Mystery Boxes," Science Unlimited Video Tape, P, 15 minutes. This activity is designed to help develop sill and appreciation for the important use of indirect evidence in drawing and supporting inferences. Emphasis on more observations to strengthen or reject an inference about an unseen object should be encouraged as long as a possibility of more useful clues seems to exist.

"Describing," AIT, Out and About Series, P, 15 minutes, color: Sam asks Sally to guess his birthday present from his description of it. After Sally's guess is way off, the children guess what they have for him very carefully. Sam guesses correctly that it is a birthday cake.

"Detecting," AIT, Out and About Series, P, 15 minutes color: Sam and Sally find hidden characteristics inside a Russian doll and an egg. At school, Molly's cool clay hides what it can do when it's warm, Sara's fruit hides a seed, and a storyteller tells about waiting for an ugly brown object to reveal the gift of a beautiful butterfly.

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INVESTIGATING MYSTERY BOXES

Television Introduction

Teacher Orientation

This introduction is designed to provide a transition into the "science activities" which you will conduct following it. You will probably want to spread the lesson activities over several days. Emphasis in this television presentation will be placed upon introducing basic processes and techniques leading to student instructional objectives as well as teaching strategies that you may use to promote these desired objectives.

The lesson centers around a gift-wrapped package which the viewers are asked to observe and make inferences as to its contents. Many of the early questions are the kind which are best answered by statements such as "We don't know" since no evidence for inferences is provided. Then the lesson suggests some ways that children can make observations to gather evidence to provide clues for inferring the contents of the box. Some emphasis is placed on developing vocabulary for communicating observations.

The Science Unlimited lesson follow-up activities focus on observations and inferences. Teachers will find phrases such as the following to be helpful:

"What did you observe which made you think that?"

"What else might you do to check your idea (or inference)?"

"What could you do with your box to find out?"

"Is there anything you can think to do to try to find out which idea fits best?"

"It seems as if both inferences could be right until we can think of some new way to get more clues."

On ten occasions during this television introduction, questions are posed and time is provided for discussion in the classroom. The following charts suggest teacher reactions and teaching strategies that may be employed during the discussion period.

SCIENCE UNLIMITED: INVESTIGATING MYSTERY BOXES

Discussion Period and Time	TV Image	Final Broadcast Statement	Suggested Statement or Questions	Teaching Strategy
1 1 min.	?	What ideas do you have about what you would do to discover what is in the mystery box?	Without opening the box, how would you decide what is in the box?	Open[6] Ended
2 30 sec.	?	How big do you think this box is?	What do you see that might help you tell how big it is?	Approval[3]
3 30 sec.	?	How heavy do you think it is?	What do you know that weighs about that much?	Approval[3]
4 35 sec.	Child holds box next to various objects	What words would you use to tell about its size?	Watch for several seconds and tell us what you discover about the size of the box.	[4]
5 45 sec.	Child compares weight of mystery box with other boxes	What words would you use to tell how heavy you think it is?	Watch to see what you discover about the weight of the boxes.	Answer[2] Evidence

SCIENCE UNLIMITED: INVESTIGATING MYSTERY BOXES

Discussion Period and Time	TV Image	Final Broadcast Statement	Suggested Statement or Questions	Teaching Strategy
6 35 sec.	Child shaking the mystery box	What words will you use to describe the sounds you hear?	Can you think of anything you know that might make a sound like that?	Process[5] Communication
7 25 sec.	Child shaking mystery box	By listening to the sound, can you tell how many things are in our mystery box?	Listen closely for sound clues. How many things would you say are in the box?	Approval[3]
8 25 sec.	Child slowly tilting the box	What does it tell you about something in the box?	The child is tilting the box slowly. Listen for several clues before you answer.	[4]
9 25 sec.	Child tilting mystery box	What do these sounds tell you about what's in the box?	What do you believe is the the box? Why did you make that choice?	Answer[2] Evidence
10 3 sec.	Child looking at mystery box	Can you think of any other way that we might learn about what's in the package?	The boy is puzzled, isn't he? Could you help him to think of any other way to solve our mystery?	Open[6] Ended
11 30 sec.	?	...name some of the things that you could smell if they were in our mystery box.	What could we put in the box that someone would know by their smell?	Process[5] Communication

Title: Investigating Mystery Boxes

Level: Primary

Aims: Towards Which This Lesson Contributes

1. The student will solve problems by gathering information, working independently, observing purposefully and drawing appropriate conclusions based on these findings.

2. The student will identify examples of scientific hypotheses and theories as evidence that man's interpretation of truth changes as his knowledge increases.

3. The student will demonstrate competency in the use of the processes of science by: (a) observing, (b) classifying, (c) communicating, (d) inferring, (e) formulating hypotheses.

4. The student will discriminate between evidence and proof, fact and theory, observation and inference.

5. The student will defend a point of view by making use of supporting evidence.

Instructional Objectives:

At the conclusion of this lesson the student will state at least two observations to justify an inferred identification of an object concealed in a closed box.

BACKGROUND INFORMATION:

This set of activities is desigend to help develop skill and appreciation for the important use of indirect evidence in drawing and supporting inferences. Therefore, approval should be given when children communicate an observation they make with their senses rather than for a lucky or superficial "correct" guess as to the unseen object. Emphasis on more observations to strengthen or reject an inference about an unseen object should be encouraged as long as a possibility of more useful clues seems to exist. The teacher should encourage and respect contradictory inferences which are supported by observations.

In other words, being "right" in this lesson means producing supporting observations. Thus, children could infer different objects for the same mystery box and still be equally right.

Objects listed should be viewed as helpful suggestions. Alternative items could be substituted according to what is most easily available. Items chosen, however, should be the kind that produce some clearly identifiable clues by indirect observation as well as some common clues (example: balls and cylinders both roll but cylinders roll only along one surface. A short sliding sound ususally indicates the object is longer than an object which has a long sliding sound).

Often a good supply of shoeboxes will be donated by a shoe store owner. It is not necessary to have all the boxes the same, but it helps in making some comparative observations. Teachers can usually obtain a sufficient supply of boxes by soliciting help from friends and pupils.

Boxes can be identified for discussion and reference in various ways. Assorted colored stripes may be added with paints or crayons. Pictures of animals might be pasted to the boxes. Numbers or letters might be used to add to the learning or review function of the lesson.

List of Equipment for a Class of 30 Pupils

22 shoeboxes or assorted sturdy boxes

scotch or masking tape

sets of objects (suggested list)

For Activity #3

- 4 ping pong balls
- 4 golf balls
- 4 like wooden or plastic blocks
- 4 plastic or metal jar lids
- 4 like bars of scented soap
- 4 like bean bags

2 pencils or pens

2 like rubber balls

2 like rubber toys (i.e., mice or dolls)

1 pair socks

Some Suggestions for Alternate Objects

- empty cylindrical can (juice, vegetable, etc.)
- small onions with a slash to release odor
- string of beads or pieces of metal chain
- ball of clay

Investigating Mystery Boxes

Activity I

Materials: 1 set of the 6 objects to be used in Activity III

Arrange the children in a semicircle around a table. Place the set of assorted objects on the table and ask the children to describe in as many ways as they can the objects and their characteristics. Discuss each object in turn. Then choose objects in pairs or in groups of three and solicit additional characteristics to differentiate between the objects. Guide the discussion to characteristics which might be useful in the later activities such as:

"the balls roll"
"the golf ball is heavier than the ping pong ball"
"the soap smells"
"the bean bag squishes"
"the lid slides when its one way and rolls when its another"

Activity II

Materials: 2 boxes, tape (scotch or masking), pencil or pen,
small extra roll of scotch tape

Take two identical shoe boxes and put the pencil in one and the scotch tape in the other while the children are watching. Tape each box so that the lid is secure. Switch the boxes behind your back several times so that the children cannot associate a box and its contents.

Give one box to one child and the other to another. Instruct them not to squeeze the boxes, but tell them they can move them in any way they want to help them decide which object they think is in their box. After one or two mintues have each child pass his box to another child. Continue the passing along of boxes as many times as seems appropriate in terms of effective use of time.

Then have the children discuss their ideas about what is in each box. Whenever possible, ask the children to state the observations which they felt were good clues.

Try to encourage other children to listen and watch for clues.

Discuss clues only as they relate to inferences about an object. Avoid comments or facial expressions that support or reject student observations or inferences.

Encourage the children to demonstrate anything they did which yielded a helpful clue. Allow one or two other children to do what was demonstrated and see if they feel the same way.

When the teacher's judgement dictates, open the boxes so children can check their inferences. Then repeat any observations which yielded productive clues, such as:

a rolling sound versus sliding sound
a long slide versus a short side
a difference in weight
- or - keep

Activity III

Materials: 18 boxes
4 ping pong balls
4 golf balls
4 blocks
scotch tape
4 jar lids
4 bars of soap
4 bean bags
or alternative sets of objects

Prepare a complete set of boxes in advance of this lesson. Use the objects which were studied in Activity One, placing one object in a box and taping the box closed. Each box should have an identifying number or other symbol (A letter or colored geometric shape marked on the box are other possible markings). Prepare enough boxes so that there is at least one for each two children. This means that there will be duplicates. Keep the scented soap boxes separate from the rest until the boxes are distributed to the children so that the scent doesn't spread to other boxes.

Arrange the children in pairs. Give one box to each pair, after discussing with them that they are to try to find out enough about what's in the box to infer (figure out) what the object is inside. Caution them not to crush or open the boxes.

As you circulate, stimulate productive observations, i.e., slowly tilting the box, listening for sounds as the box is manipulated, smelling, hefting for some sense of how heavy.

Have the children bring the box to you to tell you what they think is in their box and why. Check to see if they have made some productive observations. Record their decision for future references and give them a new box to work with.

When most children have worked with about three boxes, collect all the boxes and gather the class into a semicircle to discuss their decisions. When each box has been discussed, open the box and show what was in it.

NOTE: It might be interesting to have an extra set of objects and an extra box on hand during the discussion before the children's boxes are opened. Thus, some conflicting inferences might be checked by placing each of the suspected objects, in turn, in the extra box to see if it produces the same evidence the children had observed. This is a simple example of constructing a model in science.

Activity IV - Competency

Materials: 2 boxes, 2 rubber balls, 2 rubber toy figures,
1 pair of socks

Place a rubber ball, a rubber toy figure, and a rolled up sock on a table in the room. On the same table place a red colored sealed box containing another rolled up sock and a blue colored sealed box containing a rubber ball. Explain that the children are to go to the table during free time and manipulate the boxes to decide which of the three objects they think is in each of the boxes. Remind them that they will be asked to give reasons for their inferences.

Either have children report their decision to you when they are ready or have class discussion when all children have had a chance to investigate the boxes. Always insist that any inference about the unseen object be supported by observations providing clues.

PRIMARY LESSON

INVESTIGATING CHANGE (early primary)

COMPETENCIES

A. Processes

1. Observing
2. Classifying
3. Inferring
4. Predicting
5. Measuring
6. Communicating
8. Defining Operationally
10. Experimenting

C. Physical Science

1. A. Matter - Form/State

E. Attitudes

1. Toward Classwork
3. Toward Personal Use of Science
4. Toward Oneself

LESSONS

Lesson 1 - Actity I, Readiness Survey, INVESTIGATING CHANGE: Children discuss and demonstrate color changes that occur when various samples of colored water are mixed together.

Lesson 2 - ITV Video Module on Investigating Change. Forty-five minute presentation. See attachment.

Lesson 3 - Activity II, INVESTIGATING CHANGE: Properties of flour, salt, and water are discussed. The three substances are then mixed together. Children observe and describe properties of the new substance and discuss what changes have occurred.

Lesson 4 - Activity III, INVESTIGATING CHANGE: While working with clay, children discuss ways the shape of clay can be changed. Objects such as cookie cutters and straws are also used to shape clay.

Lesson 5 - Activity IV, INVESTIGATING CHANGE: Children use other senses to discuss the properties of a piece of caramel candy. They are then asked to predict what would happen if the candy was heated. While heating, children observe and describe changes in the caramel.

Lesson 6 - Activty V, INVESTIGATING CHANGE: Using their senses, children discuss their observations of water. After freezing the water, their observations of changes are shared. Children are also asked to predict what would happen to water if it were frozen and then heated.

Lesson 7 - Activity VI, INVESTIGATING CHANGE: Children discuss with the teacher changes they have observed in living things found in their environment.

Lesson 8 - Activity VII, Competency Measure, INVESTIGATING CHANGE: Children review changes in objects by means by a manipulative bulletin board or learning center.

Lesson 9 - Activities for further study, INVESTIGATING CHANGE: Since the activities in lesson 1-8 focus on physical change, the teacher is encouraged to involve children in activities dealing with chemical change.

CHANGE

PRIMARY

"Change," 3-2-1 Contact, P, I, 30 minutes, color, 1975.

"Measuring Change," AIT, Hands on Series, P, 15 minutes, color, 1975.

Title: Investigating Change (Diane M. Ferry and Roy W. Allison)

Level: Early Primary

Aims: Toward Which This Lesson Contributes

1. The student will demonstrate competency in the use of the processes by (a) observing, (b) communicating, (c) measuring, (d) inferring, (e) experimenting, (f) classifying, and (g) predicting.

2. The students will develop and ask questions of their environment. They will also use answers to questions to describe, clarify, and analyze problems.

3. the students will discriminate between observation and inference.

4. The students will measure (with English and metric units), gather data and use this data to solve problems.

Instructional Objectives: At the conclusion of this lesson the student should be able to:

1. State that changes occur in both living and non-living things.

2. Observe and describe changes that occur when:

   (a) Materials are mixed together
   (b) Materials are heated
   (c) Materials are cooled
   (d) Forces act upon materials

3. Identify mixing, heating, cooling, and applying force as probable causes of change.

4. Predict changes which might occur based on previous knowledge.

5. Describe properties of material before and after changes have occurred.

6. Describe changes which occur in living things.

7. Measure specific amounts of salt, flour, and water.

8. Identify examples of changes where reversal to original material form can take place.

9. Work together both as a group and individually gathering information and observing purposefully to answer questions.

BACKGROUND INFORMATION:

This lesson is designed to make children aware of changes which occur in their environment. To a child of this age changes can be very exciting but, at the same time, very confusing. The question, "WHY," is constantly asked. Activities included in this lesson are provided to try to help the child answer these questions. Seeing and making something happen are the best explanations which can be offered to the child. Learning by doing is very important to a child at any age, but especially important to a child at this age.

Changes examined in this lesson include those involving both living and non-living objects and those due to the mixing of materials, exertion of force, application of heat, application of cold, and the passage of time. A readiness activity is presented at the beginning of the lesson to help the teacher gain an understanding of the children's previous experience dealing with change, and also to introduce the children to the vast area of changes. Below you will find a brief explanation of the content area of the activities involved.

Every substance possesses its own characteristics. When two or more of these substances are mixed, individual characteristics are changed and new characteristics are formed. In one of our activities we combine flour, water, and salt to form a clay-like material which has different characteristics than those originally possessed by each individual material.

Another change explored is that of exerting force to change the shape of an object. The students use their hands and various supplementary materials to change the shape of their homemade clay.

The application of heat and coldness also cause changes to occur in some materials. Cold temperatures cause water to freeze and form ice; whereas heat, having the opposite effect, causes ice to melt and form water.

The activities are presented in a manner which allows the child to use his/her senses in carefully observing and predicting changes. Through actually being involved and "doing" the exploring, whether it be through the use of actual handling of materials through the sense of touch or through the other senses in observing carefully and predicting, the child can be made to feel very comfortable being a part of what's happening rather than an outside observer.

In presenting this lesson, it is suggested that the activities be stretched over a period of three days. Activities I, II, and III should be presented the first day. Activities IV and V can be presented the next day, with Activities VI and VII being presented on the final day. Many of the necessary materials are common household items except a few, which can be easily purchased in your local supermarket.

Total Equipment List

- Food coloring (red, blue, and yellow)
- Water
- 6 clear plastic cups or beakers
- 2 medicine drippers
- Salt
- Flour
- Mixing bowls (1/3 students)
- Measuring containers
- Cookie cutters, rolling pins
- Pencils, straws, plastic lids
- Hot plate
- Cookie sheet
- Individually wrapped caramels (1/child)
- Aluminum foil
- Waxed paper
- Cool Area
- Small cups
- Magazine pictures
- Plants
- Teacher's baby pictures
- Bulletin board
- Pictures of various items or actual items (See Activity VIII)

Activity I - Readiness Survey

Materials:
Colored water (red, blue, yellow)
Six clear containers or beakers
Two medicine droppers

Discuss with the children several changes they have observed in their environment. Stress the fact that many changes do occur in our world. Both living and non-living objects are subject to change. Have children discuss some of the changes they observe regarding both living and non-living things. Mention that they will be learning about many types of changes in this lesson.

Premix colored water and place each in a small clear container. Demonstrate the changes which occur when two colors (blue & yellow) are mixed together (green). Have students suggest and then demonstrate for the class what other colors might be mixed.

Discuss the procedure with the children as to (a) what was observed (b) what was done that might have caused the change, and (c) what new colors were made.

Activity II

Materials:

- Flour
- Salt
- Water
- Mixing bowls (1/3 children)
- Measuring containers
- Small cups

Have students work in groups of three for this activity. Each child will be given one of the three materials to be mixed together in this activity. Instruct children in each group to touch, taste, smell, and look closely at each material as it is discussed with the purpose of the children describing the properties of that material.

After measuring the proper amounts of each ingredient (Flour - 4 parts, Salt - 1 part, and Water - 1 1/2 parts). The children will mix the material in the bowls provided. This mixture should be kneaded for 6-8 minutes and then divided into three equal ball-shaped portions - one for each child in the group.

Have children carefully observe this new material. Discuss the change that has occurred. The following questions are suggested as a means of focusing the discussion in this activity as well as the activities which follow.

"How have our materials changed?"
"What things are different about the new material?"
"What did we do to that which might have caused the material to be different?"
"Can anyone think of any other things which can be mixed together to make something new?"

Activity III

Materials:

Clay
Cookie cutters
Rolling pins
Plastic lids
Pencils
Straws
Pizza cutter

Each child should be given a small ball of clay. Discuss the shape of the clay. Have children suggest different ways the shape of the clay can be changed using their hands. Have children try each suggestion as it is mentioned. Also provide some extra time for children to discover the endless shapes which can be formed.

Distribute various items such as those listed above. Have children use these items to further change the shape of their clay. Encourage sharing of materials. Discuss with the children the various shapes they made and the ways they used to change the shape.

Activity IV

Materials:

Hot Plate
Baking Sheet
One wrapped caramel/child
One small aluminum foil square/child
One piece of waxed paper/child
Cool area

Have each child remove the wrapper from the caramel and examine it carefully using the senses of touch, smell, and taste (Small nibble from corner). Discuss the children's observations. The children should then place their caramels on the piece of aluminum foil and then on the baking sheet. Ask the children to predict what might happen when heat is added.

Place the baking sheet on the hot plate and begin heating it at a low temperature. Children should watch carefully as the change takes place. Heat the caramel only long enough to show a change in shape and form. Heating too long or at too high a temperature can cause the caramel to burn or scorch which will prevent if from returning to its original shape.

Remove the candy from the hot plate and caution the children that the material is too hot to touch at the moment. Discuss the changes they observed as the heat was applied.

When the material cools enough to be handled, have the children use their senses once again to compare the new material to the original material. Discuss their observations.

Introduce a question as to whether the new material can be shaped as it was before the heat was added. Have the children try to reshape the material to make it look as it had before. It might be helpful at this point to place a few unchanged caramels on the table. After the children have reshaped their caramels on the waxed paper, place them in a cool area for a few minutes. This will help harden the material as well as provide additional reinforcement for the next activity which deals with the idea of cooling material to cause changes.

Activity V

Materials:

Small cup of water/child
Small cup of ice/child

Each child should be given a cup of water to examine. Encourage the child to use the senses of tase, smell, touch, and sight to help describe the liquid Discuss the children's observations.

Ask the children to predict what would happen if we would cool the water. After predictions have been made, distribute another cup containing ice. Explain that his new material was formed when water was put in the freezer. Have the children observe this new material and discuss the changes which have occurred.

Children can also be asked to predict what would happen if the ice was exposed to heat. Have the children observe the ice as it melts when heat from their hands is added. Discuss the change with the children.

Activity VI

Materials:

Magazine pictures of living things
Plants at different stages of growth
Teacher's baby pictures

Have children identify examples of living things in their environment. Such a list would include trees, grass, flowers, animals, people, and insects. A flannel board whould be very useful for this purpose. Present pictures of the above listed items as you question children about changes that might occur. Ask the children if they noticed any changes in themselves. At this point it would be fitting for the teacher to show some of his/her pictures as a baby, child, and adult. Suggest to the children that they bring some pictures of themselves in to the classroom and play "Guess Who This Baby Is?" game. Discuss changes which occur as a child moves through the stages to adulthood. Many bulletin board activities can be worked around this activity.

Activity VII - Competency Measure

Materials:

Bulletin board
Magazine pictures or actual material
String
Clothespins
Symbols to represent causes of change

Using a bulletin board which is visible to all students you can play a simple review type game. Have pictures attached to the left side of the board which represent materials before changes have occurred. Place corresponding pictures (after pictures) face up on the table in fron of the students. Present the first picture and describe what was done to the material to cause a change to take place (e.g. - Heating). You may also wish to use sysmbols (Sun) to represent the cause. These may be placed in between the two rows of pictures. Students are to examine the pictures on the table and select a picture which represents his/her prediction as to what change will take place.

Another method of presenting this review is to have actual examples of materials placed on the tables. Have the students match the materials before change with the material after change and relate the cause for the change.

If the latter method is used, the bulletin board activity can be set up as a learning center game. Attach lengths of string to each picture in the left-hand column. Attach a clothespin to the free end of the string. Randomly arrange the after pictures in the right-hand column. The object of the activity is to match the picture in the left-hand column with the corresponding picture in the right-hand column by hooking the clothespin to it. Daily changes can be made to include a wide range of items.

Activities For Further Study:

Since many of the activities presented in this lesson deal with physical change, additional activities representing chemical changes can be presented. The fact that some changes can be reversed, while others can not be reversed, may be presented and reinforced based on the child's experience dealing with changes in this lesson and other experiences otuside the classroom. This understanding will facilitate the concepts of "physical" and "chemical" changes when these terms are presented in the future.

PRIMARY LESSON

INVESTIGATING SIMPLE MACHINES

COMPETENCIES

A. Processes

1. Observing
2. Classifying
3. Inferring
4. Predicting
5. Measuring
6. Communicating
7. Using Space/Time Relations
8. Defining Operationally
9. Formulating Hypotheses
10. Experimenting
11. Recognizing Variables
12. Interpreting Data
13. Formulating Models

C. Physical Science

2. A. Basic Characteristics of Energy
2. G. Force and Machines

E. Attidues

1. Toward Classwork
2. Toward Interests and Careers
3. Toward Personal Use of Science
4. Toward Oneself
5. Toward Science and Society

LESSONS

Lesson 1 - Activity I, Readiness Survey, page P-24, Altoona Area School District Inquiry-Creativity Student Activities: The students use rulers, erasers, and weights (pennies) to study the relationship between fulcrum placement, work and force.

Lesson 2 - ITV Video Module on Investigating Simple Machines. A forty-five minute ITV presentation. See attachment.

Lesson 3 - Activity II, The students study the relationship between location on the lever and height/distance of propulsion. Also study effects of differing amounts of force.

Lesson 4 - Activity III, Students use a classroom door to study the relationship between location and amount of force required.

Lesson 5 - Activity IV, Students work with nails pounded into wood, and a crowbar to demonstrate the effectiveness of a lever - a day to day usage.

Lesson 6 - Activity V, Page P-26, Students work with a box of weights, rulers, and erasers to determine the point on the lever that allows them to use less force.

Lesson 7 - Activity VI, Competency Measure, Students work with common household instruments to discover points of force and resistance.

SIMPLE MACHINES

PRIMARY

"What is a Machine?" AIT, P, I, 15 minutes, color, 1976.

"Lever - A Simple Machine," AIT, P, I, 15 minutes, color, 1976.

"Inclined Plan: A Simple Machine," AIT, P, I, 15 minutes, color, 1976.

OTHER

"Making Work Easier," AIT, P, I, 15 minutes, color, 1976.

Title: Investigating Levers (Sue Hescox)

Level: Primary

Aims: From Toward Which This Lesson Contributes

1. The student will explain basic conceptual schemes of the material world using personal experiences acquired through various activities as the basis for his/her explanation.
2. The student will solve problems by gathering information, working independently, using equipment and materials, observing purposefully and drawing appropriate conclusions based on these findings.
3. The student will demonstrate competency in the use of the process of science by (a) observing, (b) communication, (c) inferring, (d) controlling variables.

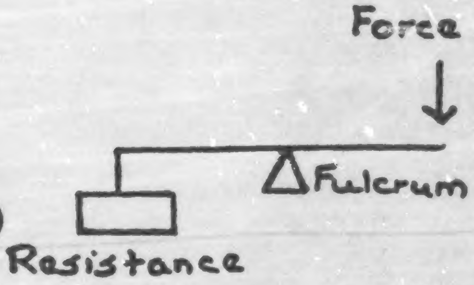
Instructional Objectives: At the conclusion of this investigation, the students will be able to:

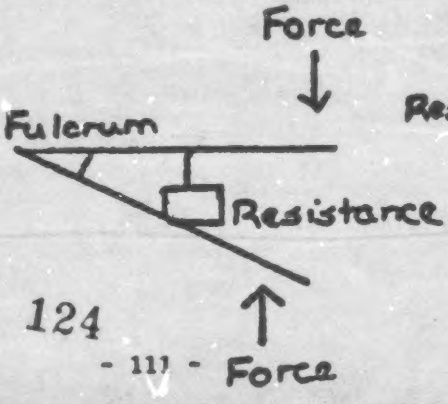
1. Demonstrate the effect of a small weight to lift a larger weight on a seesaw type lever.
2. State the points of resistance and force on levers.
3. Describe and demonstrate the use of househould levers: nutcrackers, tongs, scissors and clawhammer.

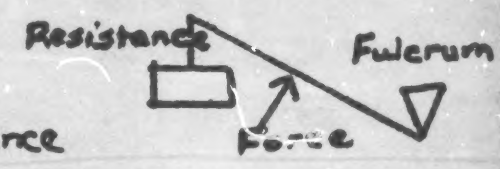
BACKGROUND INFORMATION:

By the time children have reached school age, they have manipulated and observed many types of levers. With a lever we can do work that would be difficult or impossible to do otherwise. The purpose of using a lever is to translate a small force into a larger one. The young child will soon discover that using a lever means getting work done that he/she could not do alone. The child will observe this when he/she attempts to dislodge a nail from a board with his/her fingers but discovers the ease of using a clawhammer.

Levers have three elements, the force, the fulcrum or pivoting point, and the resistance. Although a lever must have all three elements, they are not always arranged in the same order. Below are examples:







As the children work through activities using different types of levers, they should be able to describe where the applied force on the lever is and where the resistance is. It is not necessary for them to use the terms force and resistance if their own vocabulary can describe work being done and where they are doing the work For example the child might say after using a nutcracker:

"This is where I am doing the work." (pointing to the ends)
"And this is where the work is being done." (pointing to the bars above, and below the nut)

Total Equipment List for a Class of 30 Pupils:

17 erasers
several small boxes (greeting card size)
170 pennies
5 pair of scissors
3 hole punches
1 brick
3 butter dishes or paper plates
17 rulers (flat or similar flat pieces of wood)
Stones
Masking tape
3 tongs
3 nutcrackers
1 2" x 4" board 4' to 6' long
Bag of nuts

Activity I - Readiness Survey

Materials: 17 rulers, 17 erasers, 5-10 pennies per pair of students

Distribute the materials for each pair of students. Draw on the board:

Have the children balance the ruller on the eraser. Ask them to balance it using a penny on each end. Ask the children to place 2 pennies on one end and find a way to balance the ruler.

The activity can be extended to the use of one penny versus three or four pennies. Assist the children in manipulating the eraser (fulcrum) or the ruler on the eraser in their own ways to discover that a lesser weight can lift a heavier weight.

If a seesaw on the playground is available, the children can demonstrate this same principle with use of children. One child can lift two children by adjustments in the placement on the board. You can also use a brick and a 2" x 4" piece of wood to make a seesaw.

The term lever has not been used at this point. If it is not within the child's language to grasp the term, the teacher may use such words as, "We are demonstrating a way to get work done using a board and an eraser." Have the children identify where we had to use work to lift the rulers.

After the children have manipulated the rulers and pennies, solicit the generalizations about the placement of the two or three pennies on the ruler versus the one penny in getting the ruler to balance.

They may wish to demonstrate their experiments with others in the class for similar or differing conclusions.

Pictures may be drawn by the students to illustrate their conclusions.

Activity II

Materials: Same as Activity I and 2" x 2" pieces of paper.

Direct the children to balance their ruler as they did for Activity I. Then hand out several pieces of 2" x 2" paper and ask them to wad it into a ball.

Place the wad at one end of the ruler and with their hand, hit the other end. Observe how far and high the paper travels. Suggest they move the paper wad along the ruler and repeat the activity. Discuss their observations as to the heights or distances their paper ball traveled at various points along the ruler. The distance and height will depend upon a number of factors, such as the different amounts of force and the position of the wood on the eraser. The teacher should attempt to lead the children into discovering these variables and controlling of them.

Dropping erasers from different heights on the end of the ruler and measuring the distance the wad of paper travels or the height the ball reaches will serve to demonstrate the effects of differing amounts of force on levers.

Activity III

Materials: A door, masking tape

Place a strip of masking tape along the door, parallel to the floor, about 3' above the floor.

Open the door wide. Explain that you want to shut the door using the least amount of work. Have one child shut the door pushing at a point close to the hinge of the door. Direct children to push at several points along the tape. Discuss their observations as to the difficulty or ease of shutting the door at the points along the tape.

Activity IV

Materials: A small piece of wood with nails pounded into it, a crowbar or clawhammer

Hand the wood to the children and ask if anyone can remove the nails with their fingers. They will quickly discover it is not possible. Have the children suggest ways of removing the nails. If the students haven't already suggested a clawhammer or crowbar, the teacher could introduce these two tools. Give the children time to manipulate these tools.

Allow the students to use force at various points along the crowbar as they did the door and describe where it was easiest to do the work.

Optional: If the class size and classroom are appropriate, you may have the children pound their own nails into the wood. Caution and class supervision are necessary because of the danger involved in the use of these tools. Careful instructions should be given before beginning this activity.

Activity V

Materials: Small boxes or other containers to hold objects, stones or weights, rulers, erasers

Have enough boxes, rulers and erasers to allow students to work in groups of 4 or 5. Weight each box with stones.

Direct the students to lift the box using the ruler and erasers.

Have the children determine the point on the ruler that allows them to use less force. They may repeat the activity using more or less weight in the box, testing their generalizations.

Activity VI - Competency Measure

Materials: 3 nutcrackers, 3 hole punches, 3 scissors, 3 tongs, paper, nuts, 6 butter dishes or paper plates, 3 erasers

Direct the children to use each of these items in a problem solving situation.

Scissors - I want to cut this paper into 4 pieces.
Nutcracker - I want a nut cracked open.
Hole punch - I want 3 holes in this paper.
Tongs - I want to move an eraser from one dish to another.

Direct the children to discover the points of force (where they are doing the work) and resistance (where the work is being done) in using each of these tools.

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PRIMARY LESSON

INVESTIGATING MEASUREMENT

COMPETENCIES

A. Processes

1. Observing
2. Classifying
3. Inferring
5. Measuring
6. Communicating

B. Biological Science

1. Characteristics of Living Things

E. Attitudes

1. Toward Classwork
2. Toward Personal Use of Science
4. Toward Oneself

LESSONS

Lesson 1 - Activity 1, Investigating Measurement: Children compare classmate's heights and order them from shortest tallest. Children perform similar comparisons with other objects.

Lesson 2 - ITV Video Module on Investigating Measurement. Forty-five minute ITV presentation. See attachment.

Lesson 3 - Activity 2, Investigating Measurement: Children learn methods of indirect measurement by using classroom objects to measure the size of a box and predict whether it will fit under a classroom table.

Lesson 4 - Activity Competency Measure, Investigating Measurement: Children are challenged to group objects of assorted lenghts from shortest to tallest or vise versa.

MEASUREMENT

PRIMARY

"Investigating Measurement," Science Unlimited Video Tape, P, 15 minutes: The science and mathematics concept for which this lesson serves as a readiness experience are: large, small, and length. The program is centered around the measurement required for a group of children to complete a go-cart and the purchase of a pair of shoes.

"Let's Measure: Using Centimeters, Meters, and Kilometers," Coronet, P, 10 minutes, color, 1977: Two youngsters go on a metric measuring spree. With metric ruler, she measures his nose and with a meter stick, she finds out how tall he is. He measures his footsteps, and together, they measure the length of a pony and enough everyday lengths to appreciate centimeter, meter, and kilometer units.

"Measurement," AIT, First Films on Science Series, P, I, 15 minutes, color, 1975: Presents measurement as a process used everyday. Demonstrates things that need to be measured and the instruments used to measure them.

OTHER

"Measuring: A Way of Comparing," BFA, P, I, 9½ minutes, color, 1967: This film shows that measuring is a way of comparing. We often want to know more about 2 objects than simply which is longer or taller. When we do, we use a way of comparing called measuring. The film demonstrates the measuring of length, width, and volume using both animation and live action.

"Measuring Units - An Introduction," BFA, P, I, 13 minutes, color, 1968: Shows and explains all the basic units of measurement, length, width, height, square and cubic. From the simple method of measurement of a string with a stick, it moves to area measurement, and finally to cubic measurement.

"Comparing - Getting Ready to Measure," BFA, P, I, 10 minutes, color, 1967: This animated film teaches the very young student that there are many ways of comparing. It begins with comparing color, shape, and size. It progresses to comparing how objects are alike and how they are different. The final example of comparison is of weight and intuitively, the student learns that size and weight are not necessarily related when comparing objects.

"Measuring," CRM/MacGraw Hill, P, I, 13 minutes, color, 1970: Introduces the variety of ways of measuring and portrays the need for a standard unit of measure.

"Accuracy in Measurement," BFA, I, 9½ minutes, color, 1968: This animated film uses a box and ruler to demonstrate that all measurement is approximate. By subdividing the units on the ruler several times, it is shown that although we can come closer to the actual width of the box, an exact measurement can never be stated.

INVESTIGATING MEASUREMENT

Television Introduction

Teacher Orientation

This introduction is designed to provide a transition into the "science activities" which you will conduct following it. You will probably want to spread the Science Unlimited lesson activities over several days. Emphasis in this television presentation will be placed upon introducing basic concepts and techniques leading to student instructional objectives as well as techniques that you may use to promote these desired objectives.

The television presentation opens with scenes that illustrate size discrepancies - things that are too large and too small. From that point, attention is given to ways in which the appropriate size can be determined. Where discrepancies are large, they can be determined through direct examination. But, when size differences are very slight, they must be determined and compared through more careful measurement.

The program was televised in an urban environment and is centered around the measurement required for a group of children to complete a go-cart as well as the purchase of a pair of shoes for one of the girls.

The final scene of the televised program requires that the teacher be prepared with five strips of construction paper or cardboard 12 inches by 1 inch. If each of the pieces of paper was a different color, this would be helpful. The teacher should be prepared to place each strip of paper against the TV screen and cut to a prescribed length.

The science and mathematics concepts for which this Science Unlimited lesson serves as a readiness experience are: large, small, and length. On five occasions during the television introduction, questions are posed and time provided for discussion in the classroom. The charts indicate the length of discussion periods, questions raised and suggested strategies which may be followed:

SCIENCE UNLIMITED: INVESTIGATING MEASUREMENT

Discussion Period and Time	TV Image	Final Broadcast Statement	Suggested Statement or Questions	Teaching Strategy
1 (no break given)	Mother and daugther leaving house	In each case what do you think the problem is?	What did you see in the pictures that the people were having trouble with?... What else did you see happening?	Answer[2] Evidence
2 30 sec.	Girl's feet and three groups of shoes	...and which are about right?	Pick out the large ones... and the small ones...and the ones that are the size.	Ideas[1] Materials Ideas
3 20 sec.	Girl's foot next to two shoes	Without trying them on. Can you think of any way you can check to see if they fit?	Can you think of any way of telling which shoes might fit this foot?...What else might you do to find out?	Open[6] Ended
4 Extended discussion period	Scenes of measurement	Watch closely and tell about what kind of measuring you see being done.	What do you think she (he) is measuring for?	Answer[2] Evidence
5 1 min.	Five strips of wood	Take a minute to find the longest and the shortest.	NOTE: The teacher should cut strips of paper the lengths of the shoes on the screen. Number the strips to correpond with the shoes. Ask students to arrange strips from shortest to longest.	Process[5] Measurement

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Activities: Each activity will take about 15 minutes

Activity I - Readiness Survey

Materials needed: the pupils

The teacher should name two pupils who are of slightly, but obviously, different heights and ask the class who is taller. Continue to add class members to the group at the front of the room and have the remainder of the class place them in order from shortest to tallest. When the class is in doubt, have the child to be placed stand back to back with as many pupils as necessary to allow the class to compare the child's height with that of the child's classmates.

The comparison of one concrete object with another is a basic or beginning step in measurement. The teacher may wish to repeat this exercise with other materials until the class becomes proficient in ordering objects.

Activity II

Materials needed:

1. A cardbord box (A) just slightly too large to fit under a table in the classroom.
2. A classroom table.
3. A pointer, window pole or other object longer than the box is tall.
4. A cardboard box (B) which will fit under the table.

The teacher should have the cardboard box placed so that direct comparison with the table height could not be made. Ask the class if the box will fit under the table and explain that you don't want to transport the box unless it will fit under the table. Permit or encourage the use of a pointer, window pole or other long objects in an indirect comparison of the height of the box and the table. Some students may stand beside the box and mark on their body where the box touches, then walk to the table to see if the table is higher than this mark.

Questions like "Is the box as high as Joe's shoulder?" "Can Henry stand up under the table?" may help lead the class to the discovery of indirect methods of measurement.

Repeated work with objects that will and will not fit together will promote understanding.

Competencies:

Give each student a group of objects of assorted lengths, and have the students order them from shortest to longest.

Trade box B for box A during pupils' absence and ask each student to determine if the box will fit under the table as before.

PRIMARY LESSON

INVESTIGATING ELECTRICITY

COMPETENCIES

A. Processes

1. Observing
3. Inferring
4. Predicting
6. Communicating
10. Experimenting
12. Interpreting Data
13. Formulating Models

C. Physical Science

2. B. Energy: Electricity

E. Attitudes

1. Toward Classwork
3. Toward Personal Use of Science
4. Toward Oneself

LESSONS

Lesson 1 - Activity, I, Readiness, "Investigating Static Electricity," by Debbie Hoover and Roy Allison. Children are grouped to experiment with and observe the effects of bringing an uncharged and a charged comb close to a suspended ping-pong ball.

Lesson 2 - Activities II and III, "Investigating Static Electricity," by Debbie Hoover and Roy Allison. Balloons are used to investigate the characteristics of static electricity.

Lesson 3 - Activities IV, Causing Repelling Forces, and Activity V, Causing Attraction, "Investigating Static Electricity," by Debbie Hoover and Roy Allison. Children rub paper strips with pencils and observe their attraction and repulsion.

Lesson 4 - ITV Video Module on Investigating Electricity. Forty-five minute presentation. See attachment.

ELECTRICITY

PRIMARY

"Electricity and How it is Made," EBEC, P, 15 minutes, color, 1964: Presents basic concepts of electricity, explaining how it is produced, what it does, and how it is used to give light, heat, sound, and power. Uses a series of demonstrations to illustrate both static and current electricity.

"How Does a Light Bulb Work?" OXF, P, I, 5 minutes, color, 1974: Animated objects and pictures present an explanation of the principles that enable a light bulb to glow. The film illustrates why electricity creates light as it passes through the bulb's filament, and also explores Thomas Edison's role as inventor of the light bulb. This film should motivate students to want to discover more about the properties of electricity.

"Electricity, Wires In Your Home," CAHIL; AIMS, P, I, 11 minutes, color, 1964: This film presents a behind the walls study of the wires in a home, and a following of the power poles across town to the generator station with an explanation of electricity and how it works. Switches, circuit breakers, insulation, and conductors are introduced with several ways of generating electricity.

"Electricity Is All About Us," Cort, P, I, 11 minutes, color, 1958: By observation and experiment, Jean, a 5th grader, learns the characteristics of static electricity, an electrical circuit, and the ways electricity is generated. Illustrates the operation of the dry cell circuit, conductive and insulating materials, and the importance of electricty in the home and industry. (Exploring Science Series).

Title: Investigating Static Electricty (Debbie Hoover and Roy Allison)

Level: Primary

Aims: From Toward Which This Lesson Contributes

1. The student will formulate and ask questions of the environment. The student will use questions to describe, clarify, analyze problems and to provide direction for problem solving.

2. The student will solve problems by gathering information, working independently, using equipment and materials, observing purposefully and drawing appropriate conclusions based on these findings.

3. The student will explain basic conceptual schemes of the material world using personal experiences acquired through various activities as the basis for his explanation.

4. The student will demonstrate competency in the use of the processes of science by: (a) observing, (b) classifying, (c) communicating, (d) inferring, (e) experimenting.

Instructional Objectives: At the conclusion of this lesson, the students will be able to:

1. Produce a static charge.

2. Demonstrate how static charges are produced.

3. Recognize attraction between two charged objects or between a charged object and an uncharged object.

4. State the different types of static charges possible.

5. Demonstrate that like charges repel.

BACKGROUND INFORMATION

Static electricity can be produced by rubbing two objects together.

The Winter season is the most appropriate time of the year to insure successful experiences. Very low humidity is needed. So, on a cold day outside when the snow crunches underfoot, you could be assured that bringing this air indoors and heating it will produce the low humidity you need for static electricity experiments to succeed.

It is during conditions just described that we can feel and see the results of a static charge being generated. If you slide your feet across the nap of a new or high fiber rug then reach for a light switch or doorknob you can feel the charge jump from you to the switch. If this is done at night, it would even be possible to see the charge jump. Another opportunity to feel and see a static charge be discharged would be to slide across the plastic seat of a car in a wool coat (when the car is warm or dry after a long drive) and then reach for the door handle. You will both see and hear this at night.

Fur, wool or freshly washed hair are materials with which to rub plastic or hard rubber materials. Silk cloth rubbed on glass also produces static charges.

Objects which have like static charges repel each other. Objects which have unlike static charges will attract each other. A neutral or uncharged object could be attracted by a charged object. As the testing for attraction or repulsion is carried out, you should bring the two objects being tested together slowly so any action can be seen. If it is possible to safely attach two strings to the ceiling, the objects to be tested could be attached to the strings and thus it would be possible to observe if the strings were closer together near the objects (attraction) or further apart near the objects (repulsion).

The activities in this lesson should be used so that children are given an opportunity to experiment and explore with the materials. Do not give solutions before the students have had a chance to experiment. Start the children off by saying, "Find a way to make the balloon stick to the wall," "Make static electricity by using your pencial and the newpaper strip." Discussion afterward should inlcude questions like, "How did you make the ballon stick to the wall?", "What caused this?", "How did you make a static charge with your pencil and the newspaper strips?", "What happens when you pick the strips up and hold them close together?" Allow children to use these materials along with other ways they come up with on their own to make static charges.

Total Equipment List (for class of 30 pupils)

30	balloons
15	pieces wool or fur (at least 8" x 8")
30	wooden pencils
	newspaper strips - about 60 (approx. 2" x 8")
	string
5	ping pong balls
5	plastic or hard rubber combs
1	roll masking tape

Activity I - Readiness

Materials needed: 5 combs, 5 ping pong balls, 5 pieces of wool or fur, string, masking tape

Break the class into 5 groups. Give each group 1 comb, 1 ping pong ball, 1 piece wool, some string, and about 1 to 2 inches of masking tape. Have each group tape one end of the string to the ping pong ball and tape the other end of the string to a students desk so that the ping pong ball hangs free. When the ping pong balls are no longer moving have the children bring the comb close to the ball and ask "What happens as the comb approaches the ping pong ball?" After each child has done this, tell them to rub the comb with the wool and again approach the ping pong ball with the comb and say "What happens as the comb approaches the ping pong ball this time?" After all have had a chance to do it the teacher could ask, "Did the ping pong ball move away from or toward the comb?"

Activity II

Materials needed: 1 balloon and piece of fur or wool for each pair of children

Ask the children if they could apply what they learned in Activity I to make the balloon stick to the wall. Have them blow up their balloons fairly full of air. They could also approach the ping pong ball with the charged balloon to see what happens.

Activity III

Materials needed: 1 balloon and piece of fur or wool for each pair of children, masking tape and string

Make sure the balloons are blown up tightly (full of air) and tied securely. Then have them attach a length of string by one end to the balloon with the masking tape. Have the children form large groups so that each group will have two balloons. Ask the children to rub the balloons with the wool or fur pads, then hold the balloons by the string. Have the students slowly bring the two ballons closer to each other and ask "What do you observe?" "Do the balloons attract each other?" "What do the two balloons do to each other?"

Activity IV - Causing Repelling Forces

Materials needed: 1 wooden pencil and two newspaper strips per child

Place the two newspaper strips beside each other and rub them with the side of the pencil you will create a static charge on each. Then hold your two newspaper strips by one end and try to approach one with the other you should be able to make an observation. Ask the children "What do you observe as you bring the two newspapers together?" "Does this illustrate attraction or repulsion?"

Activity V - Causing Attraction

Materials needed: 1 wooden pencil and two newspaper strips per child

Place the two newspapers strips together so that one of them hides the other when they are placed on the desk top. Rub the top one vigorously with the broad side of the wooden pencil. Pick up the two newspaper strips together then separate them. Slowly approach the one newspaper strip with the other newspaper strip asking "What do you observe?" "Are these strips attracting each other or repelling each other."

PRIMARY LESSON

INVESTIGATING MAGNETS

COMPETENCIES

A. Processes

1. Observing
2. Classifying
3. Inferring
4. Predicting
5. Measuring
6. Communicating
9. Formulating Hypotheses
10. Experimenting
11. Recognizing Variables
12. Interpreting Data

C. Physical Science

2. C. Magnetism

E. Attitudes

1. Toward Classwork
2. Toward Interests and Careers
3. Toward Personal Use of Science
4. Toward Oneself

LESSONS

Lesson 1 - Activity I, Readiness Survey, Investigating Magnets: Children manipulate unmarked bar magnets and similar non-magnetic bars to observe the properties of magnets.

Lesson 2 - ITV Video Module on Investigating Magnets. Thirty-minute presentation. See attachment.

Lesson 3 - Activity II, Investigating Magnets: Investigative Science in Elementary Education: Children attempt to find the strongest and weakest place on a bar magnet.

Lesson 4 - Activity III, Investigating Magnets: Investigative Science in Elementary Education: Children test and classify common objects according to whether or not they are attracted to a magnet.

Lesson 5 - Activity IV, Investigating Magnets: Children use bar magnets and toy cars to study the attractive and repulsive forces of magnets.

Lesson 6 - Activity V, Competency Measure, Investigating Magnets: Children are given magnets and non-magnets, and asked to demonstrate properties and characteristics of magnets.

MAGNETISM

PRIMARY

"Magnets and Their Uses," BFA, P, I, 9 minutes, color, 1963: Introduces magnets and magnetism and shows the many kinds and uses of magnets. Points out that a magnet will attract materials containing iron, has poles at which magnetic attraction is greatest, and that the 2 poles behave differently.

"Magnetism," Sterling, I, J, 13 minutes, color, 1967: The laws of magnetism are explored in this film in demonstrations of natural magnets, the creation of artificial magnets by induction, friction, and electricity, the nature and behavior of north and south-seeking poles, explanations of lines of force and magnetic field, and graphic exploration of the role of electrons.

"Story of Magnetism," UVEA, I, J, 15 minutes, color, 1961: This film was producted for the elemetary science curriculum to develop more completely the pupils' understanding of the nature of magnetism, some of the relationships between magnetism and electricity and the vital importance of the work of scientists in this area to the work and life of the world.

Activity No. 5

Title: Investigating Magnets (Roy Allison)

Level: Primary

Aims: From Towards Which This Lesson Contributes

1. The student will solve problems by gathering information, working independently, using equipment and materials, observing purposefully and drawing appropriate conclusions based on these findings.
2. The student will explain basic conceptual schemes of the material world using personal experiences acquired through various activities as the basis for his or her explanation.
3. The student will demonstrate a compentency in the use of the processes of science by: (a) observing, (b) classifying, (c) communicating, (d) measuring, (e) inferring, (f) formulating hypotheses, (g) interpreting data, (h) controlling variables and (i) experimenting.

Instructional Objectives - At the conclusion of this lesson, the students will be able to:

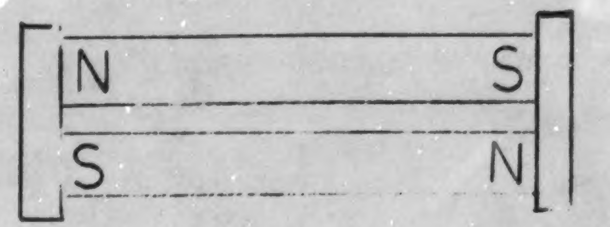
1. Distinguish between a magnet and non-magnet.
2. Find the area of greatest magnetic strength on a given bar magnet.
3. Determine what materials are not attracted by a magnet.
4. Determine what materials are attracted by a magnet.
5. Demonstrate that like poles of magnets repel and unlike poles attract.

BACKGROUND INFORMATION

Children in your class may have some knowledge of magnets. Some of these students may even tell you that "like poles repel" or "unlike poles of a magnet attract."

Don't spend time discussing magnets before introducing the activities. Have the pupils develop their concepts about magnets through the series of meaningful activities which follow.

Beware of bar magnets which have been improperly stored. Some of the best discussions may come from the materials which do not behave according to preconceived ideas or memorized rules. Properly stored bar magnets have opposite poles adjacent to each other with a keeper between them as indicated in the drawing below.



If bar magnets magnets are not stored as illustrated but are found with like poles together, you may find: (1) that both magnets are too weak for use, or (2) that both magnets are weaker than when stored and, as a pair, no longer behave as magnets "should" (i.e., like poles repel and unlike poles attract.) What has happened in the latter case is that one magnet was stronger than the other when stored and hence caused the weak one to reverse its poles.

After each activity, students should be able to use free time to investigate the materials just introduced plus those introduced in previous activities in the lesson.

Total Equipment List

Pair of bar magnets with poles marked (stamped)
Pair of strong unmarked bar magnets (marks covered with tape)
Pair of unmagnetized bars that look like above unmarked magnets (also covered with tape)
Collection of familiar objects, some of which are attracted by magnets and some of which are not
Paper clips which can be picked up by a magnet
Pencil box
Masking tape

Activity I - Readiness Survey

Materials needed: (1) the pair of strong unmarked bar magnets, (2) the pair of unmagnetized bars that look like the above magnets, (3) paper clips.

The above bars should be separated into pairs so that one bar of the pair is a magnet and the other is a non-magnet. Allow each child to examine the pair of bars. During this examination period, they may use only the two bars provided and no other device of any kind, either magnetic or non-magnetic.

Now ask the children for their observations on the two objects they have been examining. One member of the class will probably claim that the bars are magnets. (This is not really an observation but inferences since it has not yet been proven.) Ask the students how they could demonstrate that the bars are magnets. Use the paper clips as objects that magnets will attract. The pupils will eventually discover that only one of the bars is a magnet.

Activity II

Materials needed: (1) marked bar magnets, (2) paper clips.

Have the students attempt to find the strongest place and the weakest place on the bar magnet. If necessary, you might suggest that the place would hold the largest chain of paper clips may be the strongest place on the magnet.

Activity III

Materials needed: (1) bar magnets, (2) two boxes, (3) collection of familiar materials, some of which will be attracted by a magnet and some of which will not be attracted.

Have each student select from the collection of materials an object to be tested by attempting to pick it up with the magnet. If the magnet picks it up or attracts the object, have the child place the object in the box marked yes; if the magnet does not pick up the object, have the child place the object in the box marked no.

If time permits, allow the children to select personal items to be tested or items within the classroom to be tested.

You may wish to emphasize that the materials attracted by the magnet were largely iron or iron products. Most other materials such as copper, brass, wood, cloth, etc., are not attracted by a magnet. Emphasize that conclusions concerning magnetism can be drawn only for the materials tested.

Activity IV

Materials needed: (1) pair of strong marked bar magnets, (2) two plastic cars, (3) masking tape.

Tape bar magnets to the front of each of the plastic cars so that the same pole faces toward the front of each car (see drawing). Ask a student to gently push only one of the cars in an attempt to create a head-on collision of two cars.

The object of the activity is to give the pupils the opportunity to discover that like poles push each other apart (repel). Have children investigate a rear-end collision (fron of one car approaching the rear of the other). Unlike poles pull each other together (attract). The vocabulary could be introduced after the students have had an opportunity to verbalize these things in their own language.

Activity V - Competency Measure

Give the students a number of magnets and non-magnets which are similar in appearance and ask the student to:

1. Determine which objects are magnets and which are non-magnets.
2. Demonstrate the areas of greatest strength on one magnet using paper clips or other attracted objects.
3. Determine which ends (poles) on two different magnets are the same (like).

NOTES

PRIMARY LESSON

INVESTIGATING THE THERMOMETER

COMPETENCIES

A. Processes

1. Observing
2. Classifying
4. Predicting
5. Measuring
6. Communicating
10. Experimenting
12. Interpreting Data

C. Physical Science

1. A. Form/State of Matter
2. A. Energy Characteristics
2. F. Heat

D. Earth Science

5. Weather and Climate

E. Attitudes

1. Towards Classwork
3. Towards Personal Use of Science

LESSONS

Lesson 1 - Activity I, Readiness, Investigating the Thermometer: Demonstration of and practice with the reading of the thermometer scale.

Lesson 2 - Activity II, Investigating the Thermometer: Children will practice reading thermometers with a single and a double degree scale.

Lesson 3 - ITV Video Module on Investigating Thermometer: Forty-five minute ITV presentation. See attachment.

Lesson 4 - Activity III, Investigating the Thermometer: Children work in teams of three to measure temperatures of different locations, then share those with the rest of the class.

Lesson 5 - Activity IV, Investigating the Thermometer: Children work in teams of three to measure indoor and outdoor temperatures and compare class data.

Lesson 6 - Activity V, Competency Measure, Investigating the Thermometer: Children construct a bar graph to show the highest and lowest temperatures recorded and their body temperature.

THE THERMOMETER

PRIMARY

"Investigating the Thermometer," Science Unlimited Video Tape, P, 15 minutes: This activity introduces children to the thermometer as a device for measuring temperature. The science and mathematics concepts for which this lesson serves as a readiness experience are: numbers, measurement, heat energy, temperature, expansion, and contraction.

"Measuring Change," AIT, Hands On Series, P, 15 minutes, color, 1975.

"Thermometers - How We Use Them," BFA, P, I, 11 minutes, color, 1964: Thermometers and their uses are presented in close relationship to the basic primary units of the thermometers in the home and community. Terms such as degree and Fahrenheit are developed and related to our number system.

OTHER

"Thermometers and How They Work," Encyclopedia Britannica, P, I, 11 minutes, color, 1963: Explains thermometers and their uses to young children by demonstrating the three basic types - gas, liquid, and solid. Provides an explanation of the concept that materials expand when heated and contract when cooled. Illustrates temperature and how it is measured.

INVESTIGATING THE THERMOMETER

Television Introduction

Teacher Orientation

This introduction is designed to provide a transition into the "science activities" which you will conduct following it. You will probably want to spread the Science Unlimited lesson activities over several days. Emphasis in this television presentation will be placed upon introducing basic concepts and techniques leading to student instructional objectives as well as techniques that you may use to promote these desired objectives.

This activity introduction is designed to introduce the child to the thermometer as a device for measuring temperature. Following a view of a number of different types of thermometers being used in a wide variety of settings, a typical thermometer is examined carefully. The parts of the thermometer are viewed closely followed by opportunities to see how temperature affects the liquid in a thermometer.

Much of the televised program is devoted to reading a thermometer (Fahrenheit). The children will be expected to read the numbers 10, 20, etc. to 80 as well as count by twos from 70 to 80. Although the follow-up lessons require some equipment, the televised program requires no equipment.

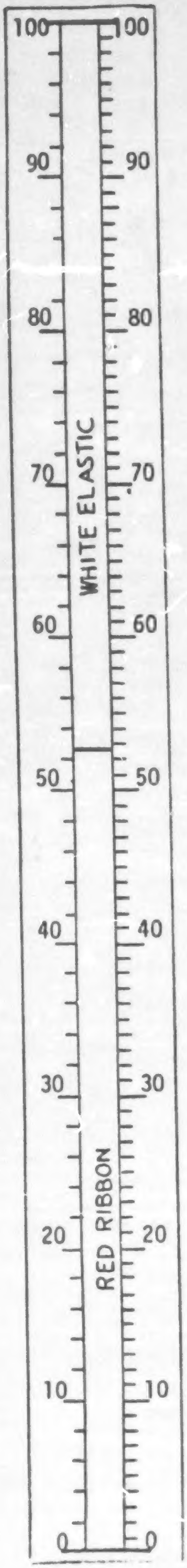
The science and mathematics concepts for which this Science Unlimited lesson serves as a readiness experience are: numbers, measurement, heat energy, temperature, expansion and contraction. However these terms are not narrated in the televised program. On eleven occasions during this television program, questions are posed and time provided for discussion in the classroom. The charts on the next page indicate the length of the discussion period, questions raised and suggested strategies which may be followed.

SCIENCE UNLIMITED: INVESTIGATING THE THERMOMETER

Discussion Period and Time	TV Image	Final Broadcast Statement	Suggested Statement or Questions	Teaching Strategy
1 30 sec.	Scenes of thermometer being used	These people all have something in common - can you tell what it is?	Can you describe what each person is doing?	Approval[3]
2 1 min.	Scenes of high and low temperatures and corresponding thermometer readings	Suppose you watch this thermometer in several different situations and tell what you see happening.	What is it like when the temperature is high? Low?	Answer[2] Evidence
3 30 sec.	Sun and Thermometer	Do you know how to use a thermometer to measure the temperature?	How would you use a thermometer? When have you seen thermometers used?	Open Ended[6]
4 14 sec.	Thermometer at 70°	Can you tell what the temperature is on this thermometer?	What number is nearest to the top of the liquid?	Ideas[1] Materials Ideas
5 15 sec.	Thermometer at 80°	Now, what is the temperature?	What number is nearest to the top of the liquid?	Ideas[1] Materials Ideas

SCIENCE UNLIMITED: INVESTIGATING THE THERMOMETER

Discussion Period and Time	TV Image	Final Broadcast Statement	Suggested Statement or Quertions	Teaching Strategy
6 15 sec.	Thermometer at 74°	What do you think this temperature is?	What is the temperature now? Can you figure out what the temperature is now?	Ideas[1] Materials Ideas
7 20 sec.	Thermometer at 77°	So, what would you say the temperature is?	Count up from seventy until you get to the top fo the liquid.	Ideas[1] Materials Ideas
8 15 sec.	Thermometer at 77° and drops to 72°	Suppose you watch the thermometer and see if you can the temperature every time it changes.	Count up from seventy until you get to the top of the liquid.	Ideas[1] Materials Ideas
9 15 sec.	Thermometer at 72° and rises to 75°	How about this?	What would you say the temperature is?	Ideas[1] Materials Ideas
10 15 sec.	Thermometer at 75° and drops to 70°	Now, what is this temperature?	Can you tell me what the temperature is?	Ideas[1] Materials Ideas
11 15 sec.	Thermometer at 70° and rises to 76°	How about this temperature?	Can you tell me what the temperature is?	Ideas[1] Materials Ideas



Science Activity: Investigating the Thermometer

Level: Lower Primary

Aims:

1. The student will solve problems by gathering information, working in groups, using equipment, observing purposefully and drawing appropriate conclusions based on these findings.
2. The student will demonstrate competency in the use of processes of science by: (a) observing (b) measuring (c) interpreting data.

Instructional Objectives:

At the conclusion of this lesson, the children will be able to:

1. read and state verbally temperature readings.
2. match the readings of a model thermometer with a real thermometer.
3. identify temperature readings as higher or lower, greater than, less than.

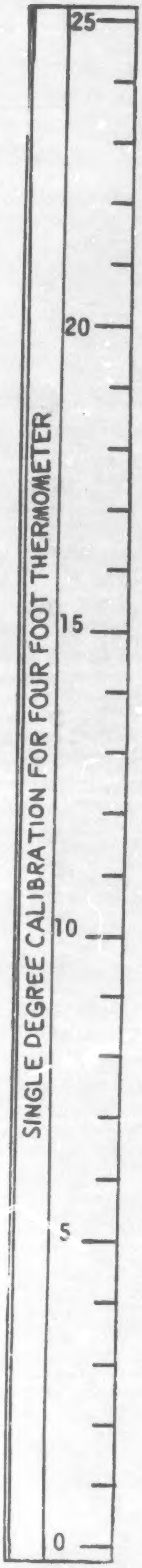
BACKGROUND INFORMATION

A cardboard thermometer model about 4 feet tall is needed for this activity. If a slit is made at the 0° mark and 100° mark an endless belt made of red ribbon and white elastic (about one inch wide) can be threaded through the slits and sewed together. With some practice, children can learn to slide the red ribbon to any reading on the thermometer.

On the right side of the ribbon marks should be made for each degree 0 through 100 as shown at the left. On the left side of the ribbon, and in another color, the thermometer should be marked 0 through 100 in two degree calibrations. An illustration of the model thermometer is at left. On the right is the calibration of the degrees on a four-foot cardboard thermometer.

Equipment for Class of Thirty:

1 large cardboard thermometer
1 glass of cold tap water
1 glass of warm tap water
A thermometer for each three of four students



Activity I - Readiness

Demonstrate the model thermometer to the children by moving the red ribbon to various locations on the scale simulating several temperature readings and ask individual students to read the temperatures. Start with easily read numbers such as 50°F, 60°F, 30°F, etc. Then 55°F, 35°F, 23°F, 61°F, etc.

Many children can be involved in this gamelike exercise if (1) one child calls out a temperature reading, (2) another child manipulates the model thermometer and (3) a third one checks the reading.

Activity II

Up to this point the children have read the side of the thermometer that has the readings calibrated in single degrees, (i.e., 0°, 1°, 2°, 3°, 4°, etc.).

Students will need some practice reading a number on the right side of thermometer (single degree) and then shifting to the left side for reading on a double degree scale. Begin with even numbers, 20°, 52°, 56°, 78°, 34°, etc. After some proficiency is gained with even numbers, try odd number readings.

Activity III

Stand the large cardboard thermometer in the chalk tray and make three vertical drawings similar in size to the ribbon on the termometer:

Give three children a thermometer and ask one (1) measure the temperature of the air in the room, (2) another the temperature of tap water and (3) a third child the temperature of his thumb. (He places his thumb gently on the bulb of the thermometer.)

Each child could be assisted by others who could (1) read the thermometer, (2) simulate the reading on the large model thermometer (3) mark the reading on each of the three chalkboard "thermometers." From the chalkboard bar graph, children could be asked to choose the highest and lowest reading. Some students might be asked to compute (and then count on the model thermometer) the difference between the readings.

Activity IV

1. Using the information collected on the temperature of air in the classroom, ask each child to estimate whether the temperature of the outside air is higher or lower than air inside the room.

2. The students should be divided into teams of three with following assignment:

A. one student carries the thermometer
B. one student read the thermometer
C. one student writes the outside temperature on a note pad

3. Upon return to the classroom, each team reports its reading of the outside temperatures. Compare the outside and inside readings.

Activity V - Competency Measure

1. Complete a bulletin board bar graph with the temperature readings of the following phenomena in order from lowest to highest temperatures:

   A. outside air
   B. inside air
   C. myself
   D. tap water (cold)
   E. tap water (warm)

2. Ask the students to choose the highest and lowest temperatures. After scrambling the paper strips of the bulletin board bar graph, ask the students to choose again the highest and lowest readings.